LOCH NESS

ADRIAN SHINE

LOCH NESS PROJECT

I have investigated Loch Ness and its mystery since 1973. My fascination lies partly in the mystery itself and partly in exploring a little understood environment. For most people, monsters are a joke yet they are intrigued, possibly because they suspect a wider dilemma; and there is one.

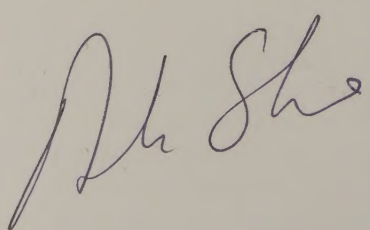
If monsters exist, then science, a mainstay of our conventional wisdom, has ignored the most exciting wildlife mystery in the British Isles. If there are none, then over 1000 people including doctors, clergymen, M.P.s, civic dignitaries, not to mention a saint, may have lied; unthinkable. Alternatively, they were sincerely and unshakably mistaken; even more worrying! It seems that "science" by which we live and work, conflicts with "people" with whom we live, work ... and trust.

Few really believe Loch Ness is a "Jurassic Park". Yet, the media stereotype monster is a plesiosaur, a long-necked, marine reptile contemporary with the dinosaurs. The lack of recent fossils does not dim the hopes of some; they point to the Coelacanth, a fish caught alive in 1938 after an absence from the fossil record of 65 million years.

So for most investigators, monsters must be real animals, either "supposedly extinct" or "new to science". But for me, it doesn't matter whether animals are very old or very new to science. They simply need to be a bit big and unexpected and that's if there are any animals at all! True investigation should simply discover the facts. An interesting facet of my work is the discovery of special things about Loch Ness, which shed unexpected light into the controversy; sometimes explaining what people are really seeing.

Loch Ness is an underwater environment, a hidden world. That's why, as a naturalist, I tend to study the things which can't be seen ... simply by staring at it.

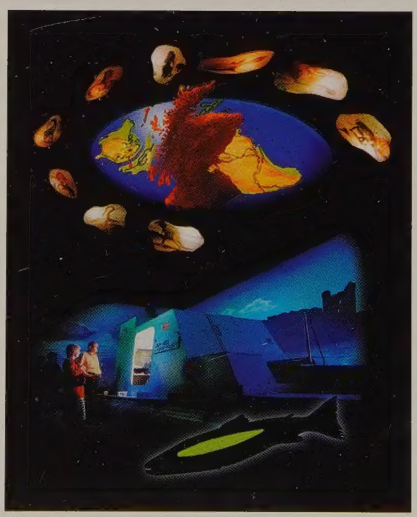
Adrian Shine



It all began in 1882, just as stories of a "huge fish" were circulating in the village of Drumnadrochit. Here, the old inn which stood on the loch-side road was being rebuilt in the sumptuous Victorian Baronial style. This new Drumnadrochit Hotel was to play an increasing part in a mystery that has captivated, or at least intrigued, seven generations and most of the world.

Around 1916, a local gamekeeper came into the hotel "with his face as white as paper". His encounter, in a small boat on Loch Ness was, like other accounts, not something people cared to talk about in those days. But all that changed with what the hotel manageress, Mrs. Mackay, saw on a Spring day in 1933. Not that she wanted publicity; she was afraid of being thought self advertising but the story leaked out and the rest, as they say, "is history". Back then, the hotel had a regular fishing clientele, often staying for a couple of weeks with ghillies taking them out onto the loch. However, by 1960, increasing numbers of visitors were touring by coach. The Loch Ness question was finally taken seriously by people like the naturalist Sir Peter Scott. The Loch Ness Phenomenon Investigation Bureau arrived and organised research began.

The Loch Ness Exhibition Centre



Award Winning Multi-media Exhibition

Now the "Drum" Hotel became the gathering point for generations of investigators. Another arrival were the new owners, the Bremner family, and the beginning of a new vision. Together with designer Tony Harmsworth, they opened a small Loch Ness exhibition in the hotel's old stables in 1980. The "Drum" became "The Loch Ness Centre" and soon a link was forged with the Loch Ness Project. The Project had succeeded the Loch Ness Investigation of the 1960s, and with it came the records of everything that had gone before. Support for the loch's exploration provided by the public exhibition guaranteed

Loch Ness Centre at Drumnadrochit

that the enterprise would become a true research centre for everything of significance since then. The Loch Ness Centre and Project association has provided support for two decades of research. The laboratories and classrooms have hosted collaborating scientists, university field trips and school visits, while logistics are provided for individual studies from undergraduate to PhD. In the last decade, some 64 separate studies have been completed, ranging over every aspect of the loch. Always the answers lead to more questions.

R.A. Bremner
Founder Loch Ness Centre

Visitors can participate too. Instead of the fishing ghillies of old, the Project's research vessel "Deepscan" now gives a flavour of what makes Loch Ness so special during summer cruises for visitors. Incidentally, "Operation Deepscan", was the Project's massive sonar sweep in 1987. This was the largest ever probe into the loch and was organised from the Centre. This was no mean task with 120 expedition members let alone 326 media crews to be accommodated.

In 1984, fire damaged the old "Drum" hotel. It was the end of an era but led to something very new as the exhibition moved in. This was only a beginning. A new design; a multi-million pound development was planned for the millennium. The grand Victorian building still looks the same as it always did; on the outside! But, inside and behind it, an architectural challenge has been met with radical use of the space left by the fire. In the "underwater" room, a clear void extends up through the entire height of the building and even the old wine-cellar has been put to novel use! Large extensions house further displays, including "The Sonar Patrol" with its laser show and the actual 12m sonar search vessel from the 1980s.

Everything in the exhibition is real! The Project researchers place their equipment here; the ROSETTA sediment coring machine for example. This retrieved and unlocked the 10,000 year time capsule of mud from the depths of the loch. It was built only yards from where it now stands. The tiny submersible "Machan" was last used over thirty years ago in rather more adventurous times! When the exhibition presentation enters the "Ice Age Lost World" 230m down, you may be sure the underwater footage of its creatures, was really filmed there, at a depth greater than the height of the London Telecom Tower.

All this may help to explain why the exhibition is not what you might expect. The partnership between exhibition, field research and most importantly, our visitors, ensures that the exploration continues and that anything you find here will be exciting, objective and, above all, truthful. As you will see, truth is often stranger than fiction

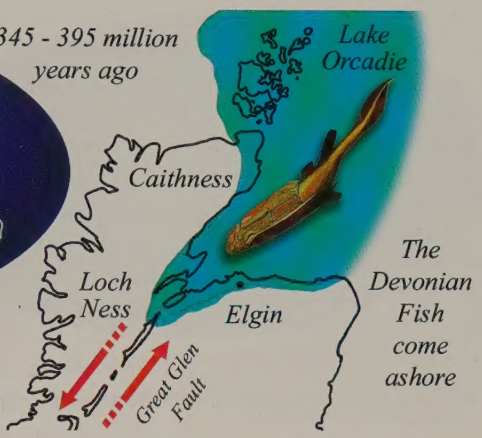
The Loch Ness Exhibition Centre is open all year at: Drumnadrochit, Inverness-shire, IV63 6TU. Telephone 01456-450573 www.lochness.com

" Scottish Natural Heritage can fully endorse the Loch Ness Exhibition ... the innovative interpretation and wide range of information provided will undoubtedly be of interest to visitors and locals alike regardless of whether or not they believe in the monster ".

SCOTTISH NATURAL HERITAGE

Scotland's Journey

Scotland and England unite 410 million years ago



A thousand million years ago and eight thousand miles away, close by today's Antarctic; the rocks that would become the Scottish Highlands were forming off the coast of a continent destined to become North America. The sands and muds were probably laid down by rivers flowing from Greenland and by about 500 million years ago they were buried, folded, intensely heated and so crystallised, to form most of the grey rock called Moine schist which surrounds Loch Ness today. Far across a slowly shrinking ocean we have called the Iapetus, waited England and the rest of Europe.

Continental drift crushed North America and Scotland into Europe some 410 million years ago, in a collision that folded and thrust up the Caledonian mountains on a Himalayan scale. A gigantic fault tore across the mountains, dividing Scotland in half and stretching out across Newfoundland. The land to the north is thought to have slipped a hundred or more kilometres to the south-west. This fault, Scotland's Great Glen, would one day hold that mysterious lake we call Loch Ness.

But it was not the glen's first lake. In Devonian times, 380 million years ago, the gigantic freshwater 'Lake Orcadie' stretched from Loch Ness beyond the Moray Firth. The Old Red Sandstone along the northern shores of the loch marks its fringes and from Inverness to Caithness, among thousands of fossil fish, are the lobe-finned ancestors of all the world's land vertebrates.

Scotland, drifting ever northwards at the speed of your growing fingernail, reached the equator where today's rain forests lie. Some of the fish evolved into moist-skinned amphibians, tempted out of the water into the humidity of the great Carboniferous swamps that would become our coal seams. In fact, the oldest known amphibian was descended from a lungfish which crawled ashore near Elgin. Amphibians had to lay their eggs in freshwater and indeed, still do. But in the 1980s, an Edinburgh fossil was christened 'Lizzie the lizard' because it had almost evolved into a reptile.

Reptiles needed no water for their eggs and so began their long march inland as the world's landmasses clustered together and Scotland was squeezed into the dry centre of the super-continent Pangaea.

Amphibian life clings to the water margins

Carboniferous Swamps 280 - 345 million years ago

Change Forces Evolution

Permian Deserts 230 - 280 million years ago

The Reptiles march inland

By Permian and Triassic times, the Great Glen had reached the latitude of today's Sahara, and the Moray Firth was filled with desert sand dunes. At Elgin, the footprints of reptiles are preserved in the New Red Sandstone and their fossils show them evolving into the mighty dinosaurs.

The Glen truly became "Jurassic Park" 205 million years ago as a great inland sea flooded the Moray Firth desert. Rich blooms of plankton settled to form the North Sea oil and gas fields and at Helmsdale a plesiosaur left its bones. The mountains around the glen were fringed with conifer forests where dinosaurs roamed. Here too, were the small, newly evolved mammals, hiding underground at first but as most of the world's land slid north into more seasonal temperate latitudes, their warm blood gave them an advantage. They could be more active at night and during the winters, which were becoming more noticeable.

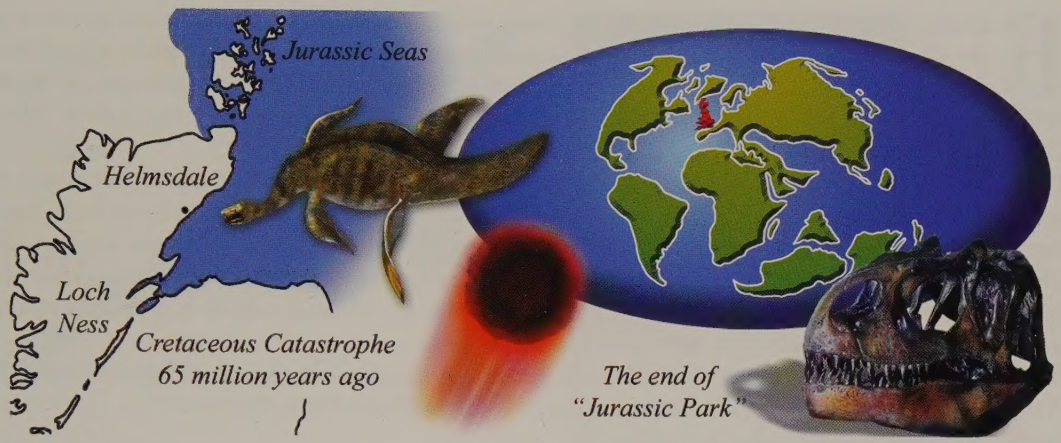
The Jurassic world fragmented as the Atlantic Ocean opened, leaving Scotland behind as part of Britain. At the end of the Cretaceous, 65 million years ago, came the ultimate demise of the dinosaurs following huge outpourings of lava in India and the impact of an asteroid in Mexico. The land now belonged to the mammals and birds which filled the vacant niches left by the reptiles. Some mammals took to the sea, to become the whales and dolphins, replacing the great sea reptiles, like plesiosaurs.

Finally, the great landmasses clustered around the North Pole. Now there was land that snow could settle upon, reflecting away the sun's heat. The world entered the great Ice Ages, setting the stage for the rise of man. The Great Glen, a fault torn across the mountains so long ago was scoured and moulded by glaciers a kilometre thick. So Loch Ness is no Jurassic lost world. Its inhabitants are a legacy of the ice. It is unlikely that cold-blooded reptiles could reproduce in these deep, chill waters. Amphibians are chained to freshwater and so never evolved any saltwater species to come in from the sea after the ice melted. The warm-blooded mammals could cope with the cold but pay the price of a high metabolism, demanding more food and having a more frequent need to breathe at the surface.

With each glacial advance and retreat, the ice burden would depress the earth's crust and then melt-water would raise the sea level. Before the land could recover, the Glen might sometimes become an arm of the sea. Some have speculated that large sea creatures could enter and become trapped. The sea may have invaded before the last glaciation 120,000 years ago.

However, it seems that as the last ice melted 10,000 years ago, the sea did not rise quite enough to flood into the loch. The same can be said of catastrophic tsunami waves which flooded the site of Inverness just over 7,100 years ago. These were caused by the 'Storegga Slides' - huge underwater landslides off the coast of Norway. Loch Ness, relieved of its ice burden, has now risen to a height of 16 metres above sea level.

A Legacy of the Ice



After a brief re-advance eleven thousand years ago, the glacier retreated up the glen. Ice dams holding back lakes in Glen Roy and Glen Spean gave way in successive floods, leaving traces of the old shorelines as "The Parallel Roads" visible on the hillsides. The final outpouring may have laid the gravel foundation of Fort Augustus before roaring on to carve the channel of the River Ness. This event, probably the greatest flood in the British Isles, could have raised the level of Loch Ness by some 4m at that time and cut the terraces around the shoreline which were once seen as evidence for the sea entering the loch. What effect this might have had on the inhabitants of the loch may be left to speculation!

The new lake was colonised by migratory fish from the sea. Many still journey up and down the River Ness; young Salmon to the Iceland feeding grounds and Eels to and from their spawning in the Sargasso Sea. Even a flatfish, the Flounder, has found its way. Other fish like the Brown Trout and the numerous Arctic Charr, now spend their whole lives within the loch, possibly because of rising sea temperatures.

Pollen grains in the deep-water sediments tell of arctic tundra vegetation gradually turning to forest. First came the wind-borne seeds of birches, then more slowly, hazel and oak which relied on squirrels and jays to spread their acorns. Scots pine appeared eight thousand years ago and built up the Great Wood of Caledon, inhabited by beaver, wolves, and bears. Hunter-gatherers pressed forward, behind the retreating ice. Living from their environment, they left no mark upon it. But the Caledonian Forest was doomed as Neolithic farmers cut nature's ties with the first furrows of their fields. The forest has dwindled ever since.

Along the glen, ebbed and flowed the turbulent history of the Highlands, leaving a flotsam of forts and castles. The nineteenth century opened up the country, especially Thomas Telford's Caledonian Canal completed in 1822. This linked the lochs of the Great Glen into a sixty mile passage from sea to sea. Passenger vessels came and gradually Highland traditions and folklore became more widely known.

The Ice Age starts 2.4 million years ago. The mammals are prepared for the cold

Britain's Greatest Lake

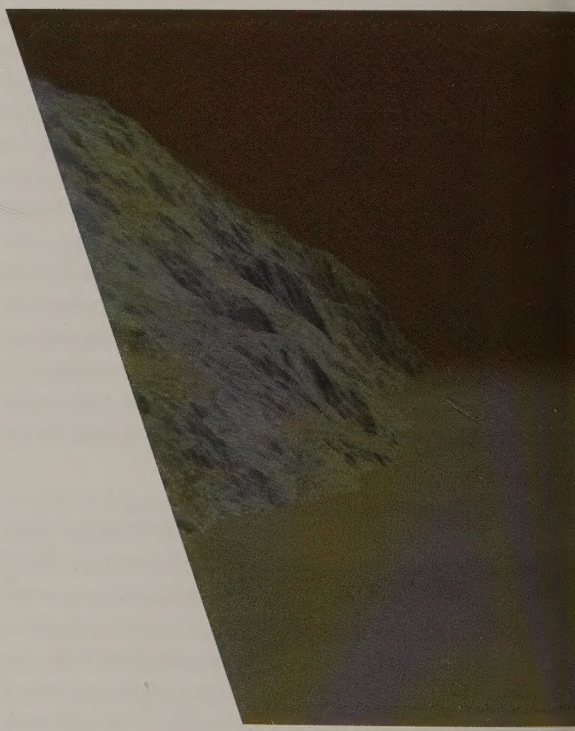
Faultline origins, and the legacy of the ice, have wrought an unusual trench-like basin, very regular and deep. Rock and clay walls plunge steeply into the abyss, where a flat plain of undisturbed sediment records 10,000 years of history. It is divided by a mound of sand discharged by the River Foyers. Near Urquhart Castle is the deepest point at 227m, enough to submerge the London Telecom Tower. The Millennium Wheel or Edinburgh Castle would fit in almost twice.

This is not a rich productive lake. The catchment area is almost 2,000 square kilometres, but mostly hard, ancient insoluble rock, yielding few mineral nutrients to the dark peaty water of seven rivers and a hundred streams. The lack of nitrates and phosphates is important. They are essential fertilisers for algal plants which in turn limit the rest of life in the food chain including larger creatures. These insoluble Moine schist rocks also explain why there are no caverns or tunnels for monsters to hide in or travel through, as suggested by folklore. There is no limestone around the loch.

But Loch Ness is the greatest volume of freshwater in Britain; more than in the whole of England and Wales put together; enough to immerse every human being on earth three times over.

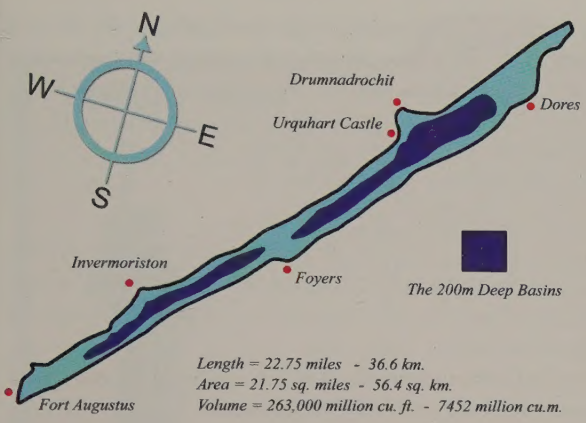
Room enough perhaps, for a few mysteries!

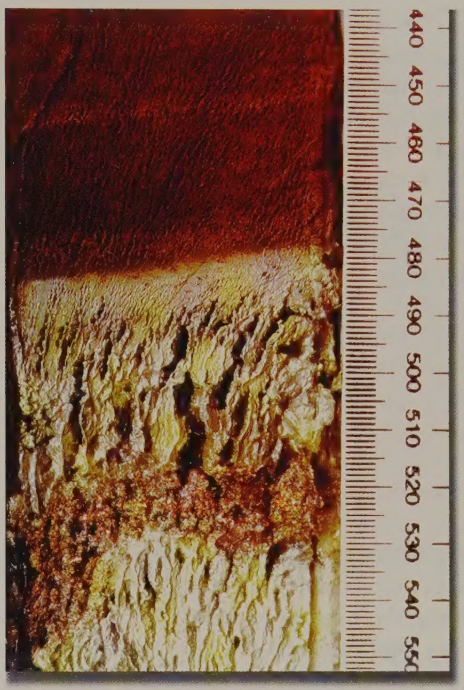
The wire-sounding machine

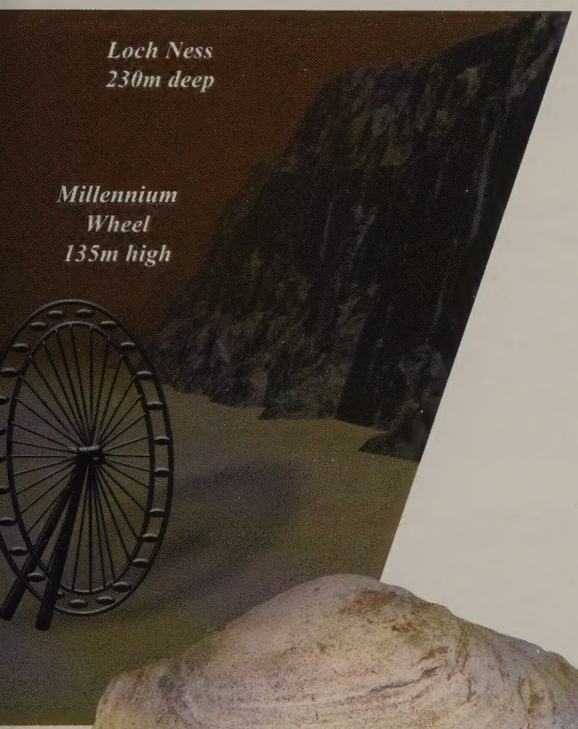


Sir John Murray had been a biologist on HMS Challenger's oceanographic expedition from 1872-76. He believed that it was as important to know the depth of a lake as the height of a mountain. In April 1903, his "Bathymetrical Survey of the Scottish Lochs" used a wire-sounding machine to take 1700 depth measurements in Loch Ness. The maximum depth was 754ft (230m). Claims for greater depths have proved to be sonar anomalies. In 1991 the Loch Ness Project made the first full hydrographic sonar survey. The greatest depth found was 227m.

Into the Abyss







In 1994, our core sampling programme penetrated 5 metres of layered brown lake sediment, down to material dated at over 9,500 years. Below this comes a sharp division to blue-grey glacial clay. About 3cm below this transition is a layer of coarse gritty sand which might have come from the Glen Roy ice dam collapse, referred to by the Icelandic term 'jökulhlaup'. There is no evidence of the sea entering the loch at this time.

However, there is evidence of a marine incursion just prior to the last glaciation. Ironically, this comes from much shallower water and a happy accident. In 2002, a team led by Bob Rines were raising an anchor. Frank Dougherty, the geologist, retrieved some shells from it and passed them to David Martin of the Loch Ness Project. He established that the shells were marine and that the surrounding clay had traces of other invertebrates.

Dating techniques suggest that the community was living about 120,000 years ago. It is remarkable that this portion of ancient sea bed seems to be undisturbed by the glaciers

Myths and Legends

The land we mastered, water keeps its mystery; a threshold to another world. The folklore of people everywhere, sees lakes as an abode for monsters. If there are any real monsters left, then water is their most likely refuge. However, to society at large, folklore and fact seldom mix.

Yet, few are aware of just how strong the human testimony from Loch Ness actually is. There are over a thousand reports which are more than most people think. Witnesses are not drunk and they come from all walks of life. Almost all of them are wholly sincere. The Loch Ness Monster did not have its origins in the Scottish tourist industry; there are more reports from visitors than from the residents who are generally more reticent. Nor is the monster a wholly recent invention, though the modern Nessie stereotype certainly is.

But there is a difficulty. There is more than one kind of monster report! To understand why and perhaps to find grains of truth behind a myth, we must gather the threads of legend together.

Ever since the prows of the Viking longships bore the Sea Dragon as a figurehead, Norse and Celtic folklore spoke of the "Orm" of northern waters. Sea-serpent sightings were still debated with interest during the nineteenth century. Some of the reports were from the coast of Scotland.

The story of St. Columba's encounter in 565AD was clearly intended to show the power of Christian prayer over pagan beliefs. Some of these beliefs survived though. Much later, Highland folklore was to speak of an ill-omened Kelpie or Water Horse in many lochs. It would drag unsuspecting travellers into the water to devour them.

HISTORY

565 A.D. **SAINT COLUMBA**

This Christian missionary to King Brude of the Picts, "drove away a certain water monster" in the River Ness. His biographer, St. Adamnan, wrote that one of Columba's followers was attacked as he swam across to collect a boat from the other side. The Saint "formed the sign of the cross in the empty air" saying "Think not to go further nor touch thou that man. Quick! Go back!". The beast "fled backwards more rapidly than he came".

These were seldom matters confided to fashionable Victorians touring through the new Caledonian Canal but sometimes, in the camaraderie of their outdoor expeditions, fishing ghillies and deer stalkers might speak to the hunting and fishing gentlemen from the south. So it was that in 1857, Lord Malmesbury recorded a description of the 'Lake Horse' of Loch Arkaig given to him by a stalker and his

FOLKLORE

1st July 1853 **THE KELPIE**

The Inverness Courier reports "A scene from Lochend".Two strange animals were sighted. Some "thought it was the sea-serpent coiling along the surface, and others a couple of whales or large seals". The inhabitants made ready with battle-axes and pitchforks. At last,a "venerable patriarch" was about to fire his gun when he threw it down and shouted "God protect us they are the Water Horses",the ill omened Kelpies of folklore.They did turn out to be horses; two ponies from the Aldourie estate over a mile away!

A Strange Fish

boy. He emphasised how superstitious they were about it. In 1895 the Duke of Portland heard from the fishing ghillies, of "a horrible great beastie as they called it, which appeared in Loch Ness".

Yet, at least as early as 1868, there was a more solid, local tradition. On October 8th, the Inverness Courier reported a curious incident at Abriachan. A "huge fish" was washed up dead on the beach. It was about 2 metres long. Some thought it was the strange fish which had "been occasionally seen gambolling in the loch for years back". It was finally pronounced to be a skinned dolphin, possibly thrown overboard by "the waggish crew" of a passing fishing boat to fool "the primitive inhabitants of Abriachan". This incident is the earliest reference we've found to something more than the Water Horse of legend.

WITNESS

1933

MRS. A. MACKAY

Mrs.Mackay,the manageress of the Drumnadrochit Hotel, was on the road from Inverness when she saw something resembling a whale. Her story was picked up by Alex Campbell, water bailiff and enthusiast of the legend. His article published in the Inverness Courier for the 2nd May is seen as the birth of the modern legend.

Around 1916, James Cameron, the head keeper of the Balmacaan estate, came into the Drumnadrochit Hotel "with his face as white as paper". He had been fishing when a huge animal surfaced by his boat. Then in 1933 the hotel manageress, Mrs. Mackay saw "the beast" and a sensation began. As north shore road improvements removed the screen of trees and increased the flow of visitors, there were more sightings. Most were and still are, of a huge multi-humped sea-serpent undulating across the loch. It was so powerful that waves often broke on the shore. However, there was another sort of monster about to make an entrance. Stories of "strange fish" were about to be brushed aside.

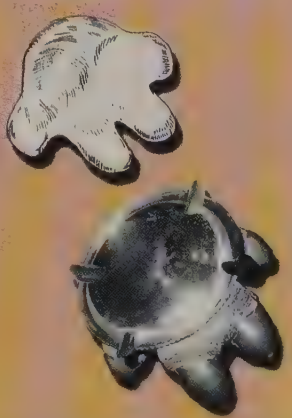
On the 4th of August, unprecedented news came from a Mr. Spicer. Driving along the south shore on a hot July afternoon he'd glimpsed, as it crossed the road, "the nearest approach to a dragon or prehistoric animal that I have ever seen in my life". He only saw it for a few seconds but it seemed to have a long neck and ponderous body. This was the first long neck report. Spicer had recently seen the film "King Kong" and considered what he had seen resembled the screen animation of a Diplodocus.

It was the long neck which alone created the world sensation of a "prehistoric" plesiosaur. But in the midst of industrial depression, it was definitely

JOKES & HOAX

1933

MASTER HOAXER



Daily Mail sponsored Marmaduke Wetherell, big game hunter and master hoaxer,gravely submitted plaster casts of some strange footprints to the British Museum. He'd made them with one of his trophies,a hippopotamus foot ashtray. He was about to create the ultimate hoax which lasted for 60 years.

A New Sensation

entertaining. Prehistoric monsters had been in vogue since the Crystal Palace exhibition of 1854 and Conan Doyle's 1912 book "The Lost World".

The sightings rocketed and now began to include long necks actually in the water. By September, Alex Campbell the water-bailiff, had also claimed a plesiosaur sighting. Media attention grew but scientific interest waned. The loch became a national joke in December when the Daily Mail newspaper sent a big game hunter to the loch.

However, the next summer saw a serious expedition mounted by the insurance magnate, Sir Edward Mountain during his holiday at Beauly in 1934. Twenty unemployed Inverness men were enrolled as "watchers for the monster" and paid £2 a week. Eleven sightings were made and five photographs taken, most attributable to boat wakes. On 15th September, the expedition's leader Capt. James Fraser, took a film from near Urquhart Castle. Sadly, the film has been lost but when shown to scientists they did at least believe that it showed a living animal. A seal!

But sightings persisted and thanks to authors Rupert Gould, Constance Whyte and others, there are now over a thousand records. Eyewitness testimony is still the most impressive category of evidence because of its sheer volume and the manifest sincerity of the observers. Enthusiasts viewed scientific reticence as an affront to eyewitnesses whose testimony would convince many a judge and jury. The refusal of science to accept the evidence of ordinary people roused a band of amateurs to confront academic arrogance in a crusade for truth. They were seldom naturalists, who generally recoiled from the prehistoric monster promoted by the media. Often, the hunters were engineers. They relished the technical challenge of search and observation in the dark and hostile underwater environment. Though their monster theories widened the gap with scientific credibility, their methods would reveal much about the loch.

WITNESS

15th June, 1965 **IAN CAMERON**

One evening, Detective Sergeant John Cameron was with a friend, fishing from the shore. They saw a "whale-like object" between twenty and thirty feet long. They concluded that it was animate because it turned unexpectedly across the wind. There were other witnesses and the incident is one of the longest on record.

WITNESS

Oct 14th 1971 **FATHER GREGORY**

Father Gregory Brusey, a monk from Fort Augustus Abbey, took a guest down to the loch-side. They saw a neck they judged to be 10 feet high. It swam towards them and submerged with a sideways motion.

Eyewitness Testimony

In the end, the scientific method was applied indirectly in a study of the loch's environment which shed unexpected light upon the controversy. But that was in the future.

However, even at the time, many people thought that the reports owed much to imagination. We now know more about the fallibility of eyewitness observations and often it has as much to do with rationalisation as imagination; that is, trying to make sense of what we see. Seen over water, especially calm water, it is hard to judge the size of an unknown object. Nevertheless, if people were seeing large animals, it was perfectly logical to start by looking for large animals.

WITNESS

July 30th 1979 — ALASTAIR BOYD

While Alastair and Sue Boyd parked in a lay-by above Temple Pier, a huge hump surfaced. It was about the size of a yacht hull but in the time it took to get their camera, it disappeared.

The Loch Ness Project believes that almost all reports are sincere but perception over water can mislead, reflecting our own expectations. Our analysis showed for the first time that although there were reports of a beast or strange fish dating back to 1868, there were no records of long neck sightings before the Spicer's encounter on land made the first connection to plesiosaurs. We wondered whether the expectations of a long neck might influence perceptions. Experiments did prove that expectations could sometimes influence recollections. In our case, because the observers were prepared for the experiment, their expectations were more focused around their thoughts about how we were contriving the event.

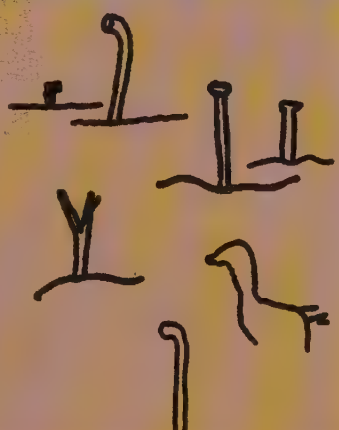
But the impressive eyewitness testimony revealed by Constance Whyte in her 1957 book 'More than a Legend' certainly justified an investigation. This, together with a series of puzzling chance photographs which appeared over the years began to interest a few members of the zoological community.

Organised investigation began in the spring of 1960 and slowly some answers, at least to the "Sea Serpent" and Plesiosaur sightings began to emerge.

TESTS

1991 — PERCEPTION EXPERIMENT

We invited people to observe and sketch an object surfacing. A third of the observers saw a submarine periscope, flagpole, tree branch, water bird or a crude model of a head and neck. Actually it was a simple wooden post and to be fair, most people got it right.



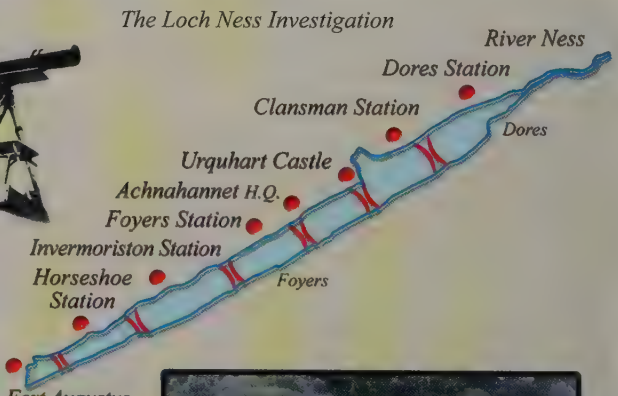
Loch Ness Investigation

Among the handful of "classic" Nessie photographs, was "The Surgeon's Photograph" of 1934: the long necked embodiment of a plesiosaur.

By 1960, the persistence of sighting reports interested two scientists at the Natural History Museum in London. Dr. Tucker inspired an Oxford and Cambridge expedition in the spring of 1960 led by Peter Baker, which quickly explained the sea-serpent sightings. Dr. Burton, the other scientist, lent a cine camera to engineer Tim Dinsdale. Within six days he filmed an indistinct object ploughing through the water. Burton believed it was a boat but Dinsdale, the lone prospector, devoted his life to vindicating the eyewitnesses.

One person who thought the matter should be resolved was the naturalist Peter Scott, son of the famous explorer. He met another Antarctic "hand", the MP David James, whom he persuaded to read Constance Whyte's book. The result was the "Loch

David James



The RaynorFilm

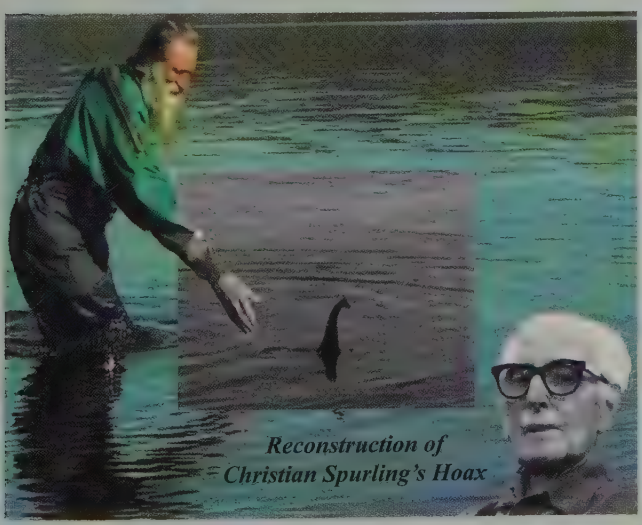
Hoax

Ness Phenomenon Investigation Bureau" which formed in 1962, mainly to collect and collate sighting reports but under the energetic leadership of David James, a decade of surface surveillance began.

On the high ground at Achnahannet the camera batteries dug in for a war of attrition against the law of averages. The youth of the 1960's took a stand against establishment science. In calm "Nessie Weather", mobile units carried them to vantage points along the north shore. Eventually, they covered 90% of the surface area. The objective was to repeat those classic photographs on good quality film.

David James, with his background of naval service and Antarctic exploration brought an acute mind and outstanding organisational ability to the quest. He showed bold ingenuity in his early expeditions with rock-blasting to simulate the 1930s road building and the last of the wartime searchlights probing for nocturnal activity. He turned a national joke into something like a national endeavour. Using his position ruthlessly, he had panels of eminent zoologists and barristers examine his evidence, together with Ministry of Defence photo-interpreters. The investigation revealed a definite correlation between calm weather and sightings. They collected some 258 sighting reports and took film on 12 occasions. Their best film was shot in 1967 by Dick Raynor. The photo analysts concluded that an object at the head of the wake may have been 8ft long.

Despite continuing sighting reports from visitors and ten summers of observation, the snatches of film bore no relation to the classic pictures. On reflection, these "classics" differed too much from one another to be real pictures of the same animal. Loch Ness has always been fair game for hoaxers. Perhaps it was no coincidence that all the real classics were taken in black and white within the first thirty years of the controversy, before colour film came into more general use after 1960. Even the great 1934 masterpiece the "Surgeon's Photograph", would be exposed as a hoax.

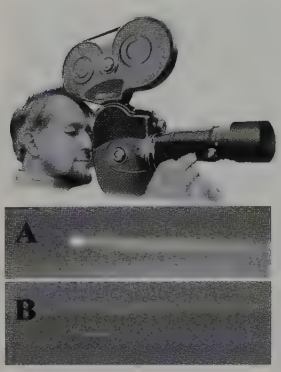


Reconstruction of Christian Spurling's Hoax

It was on the 19th April 1934, that Kenneth Wilson, a surgeon, claimed to have photographed an upraised "plesiosaur" head and neck.
Sixty years later, it was exposed as a hoax at the Loch Ness Centre. It was a model constructed by Christian Spurling, stepson of the hoax mastermind Marmaduke Wetherell of hippo foot fame. It was photographed by Wetherell's other son, Ian. The supposed photographer, Kenneth Wilson, was just a willing stooge. He had actually confessed as much, at least twice!

The hoax took a long time to unravel, because the surgeon was given the photographic plates by a friend, Maurice Chambers, who also knew the Wetherell family. Hence, the surgeon was never associated with the Wetherells and didn't know the method. All he was required to do was to take the plates to Inverness for development. Ironically, palaeontologists have now discovered that plesiosaurs could not raise their necks anyway!

Misleading Monsters

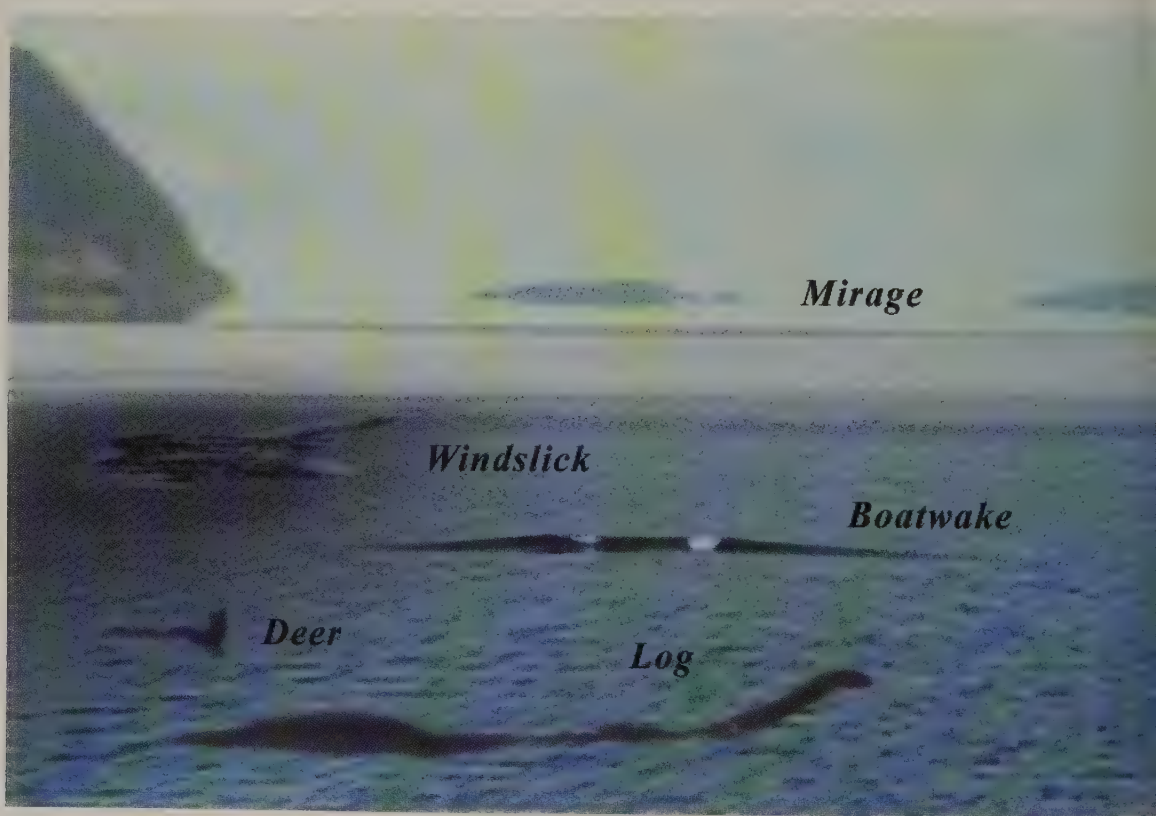


On 23rd April 1960, Tim Dinsdale, took a 4 minute film, of something moving across the loch. In 1966, Britain's "Joint Air Reconnaissance Intelligence Centre", (JARIC), concluded that "it probably is an animate object".
In 1982 we found many film frames (A), showing a "helmsman" similar to one in a boat Dinsdale filmed later (B).
It was not until 2005 that members of the original "JARIC" assessment team confirmed our findings. They stated that the image "has the overall appearance of a small craft with a feature at the extreme rear, consistent with the position of a helmsman".
Tim Dinsdale's integrity was never in doubt but the episode was a very clear demonstration of the loch's power to deceive.

(Tim Dinsdale courtesy Nicholas Witchell & A & B Tim Dinsdale)

The long years of surveillance had shed light on hoaxes but also showed how sincere eyewitnesses could be misled by the loch's many illusions, particularly on calm water. Of course, on this particular water, almost anything can trigger perceptions. Wind-slicks, boats, seals, water birds and floating logs have all caused sightings.

The multi-humped sea-serpent sightings were boat wakes. Trawlers using the canal are out of sight by the time their wakes come ashore. For many years since 1931, the "Scot II" plied the loch, throwing up sinuous, serpent-like waves with her ice-breaker bows, as shown opposite. Here, the waves will continue past the castle even though the vessel has stopped and turned.

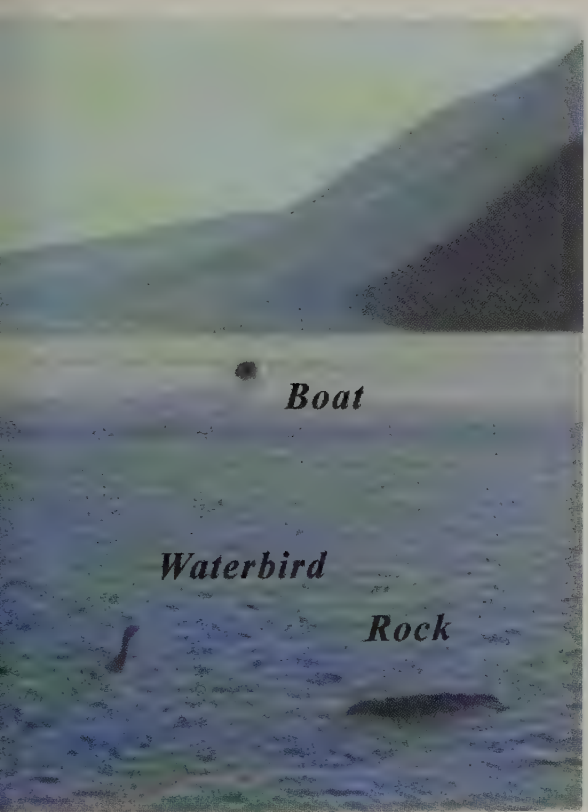


Illusion

A boat wake at Urquhart Castle

Mirages distort images and Loch Ness is particularly subject to them. Its huge volume reacts slowly to seasonal temperatures. So, no winter actually freezes the loch and snow seldom lies along its shores for long. Only the top water warms in summer, floating on the denser, colder water underneath, which remains at about 5·5°C. But this happens very slowly, so the water is often colder than the air in summer and warmer in winter. This heats or cools the lower air making a kind of distorting prism. Objects then look taller, especially in calm " Nessie weather ".

Alex Campbell withdrew his plesiosaur sighting after seeing cormorants enlarged by mirage. Perhaps it was the heat haze that hot July afternoon of 1933 which conjured the writhing shapes seen by the Spicers across hot tarmac beyond the brow of a hill.



Seals occasionally enter the loch and could account for land sightings. Deer swim in the loch more often than might be expected.

Even so, the sightings record was undiminished. In human terms, the evidence for unusual creatures in the loch was still overwhelming, yet photographic surveillance on the most massive and protracted scale could not produce verification. If the camera watch had proved anything, it was that there was no one cause of monster sightings. The popular stereotypes were nothing to do with the "beast" of local encounters. Also, a real aquatic creature would only show a tiny proportion above the surface. Even the best telephoto lenses might start an argument but couldn't finish it. As the camera stations closed down in 1972 the search moved underwater.

Perhaps this was an evasion of the basic question of eyewitness verification but it was seen as more direct and active. To counter the huge scale of Loch Ness, expeditions to small Irish loughs with similar traditions began in 1968. Finally, a spectacular report from the west, resulted in a new group, "The Loch Morar Survey".

Operation Groundtruth

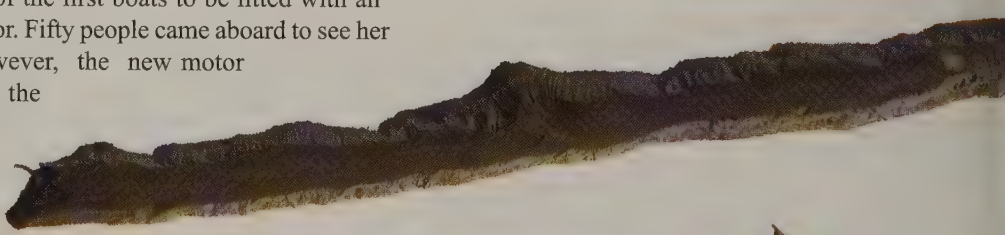
The Loch Ness Project is concerned mainly with natural history but in the course of our work, we have noted objects on the loch bed. The Great Glen has been a route-way for over 2000 years and perhaps it is time for artefacts of historical interest to be recorded. We call this ongoing search by sonar and underwater cameras "Operation Groundtruth."

Below is a sonar view of the bed of Loch Ness, made during a collaboration with "Kongsberg Simrad" using advanced "swathe sounding" sonar technology. Note the "fans" of sediment deposited by the rivers.

John Cobb's "Crusader"

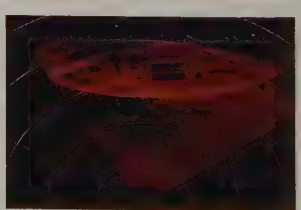
The Zulu "Pansy"

An early success for Operation Groundtruth came on 3rd August 2002 with the discovery of the intact wreck of an 80ft "Zulu" class, sailing fishing vessel near Foyers. This was identified as the Banff registered "Pansy" (BF 1327) built in 1903. In 1909 she was one of the first boats to be fitted with an auxiliary motor. Fifty people came aboard to see her trial run. However, the new motor had banished the crew to the bows



and a contemporary account records that they "suffered a good deal from excessive ventilation during the winter owing to the foremast projecting through the forecastle and leaving a big aperture when lowered, as is always done when the boat is riding to her nets!" The above picture was taken in 1911 and shows the owner James Lovie and his crew, including his son Peter. It was Peter's grandson David who provided the photograph in 2003 at which time his own son and grandson were still fishing.

The "Pansy"

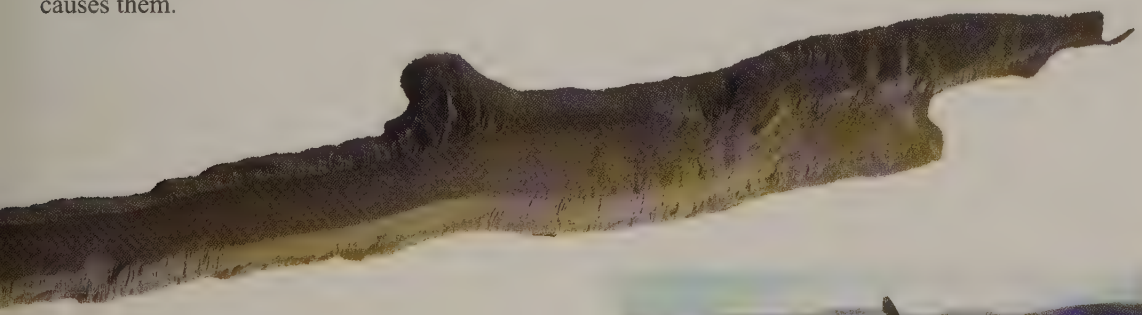


"A Gallant Gentleman"

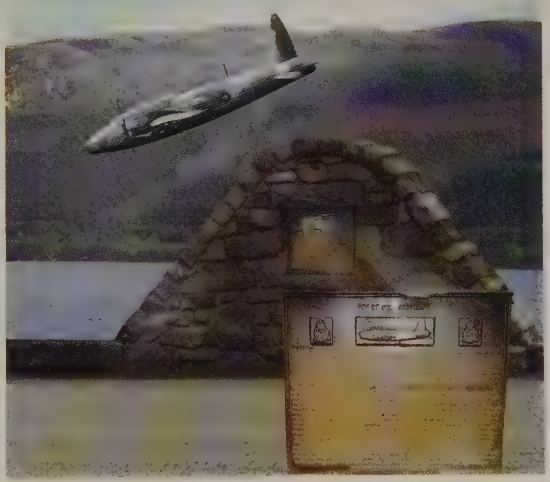
In 1952 John Cobb, land speed record holder at over 390 mph, brought his jet powered "Crusader" to Loch Ness to attempt the water speed record, which stood at 178.4 mph. Snatching a chance calm on the 29th September, the support vessels rushed into position. Leaving the measured mile at over 200mph, Crusader hit a boat wake and disintegrated; killing John Cobb whose body was recovered. An enquiry began at the nearby Drumnadrochit Hotel. Fifty years later, that enquiry was reconvened in the same building by the Loch Ness Project. Our purpose was to find Crusader as an anniversary tribute to the "gallant gentleman" honoured by a memorial just south of Urquhart Castle. *(J Cobb photo courtesy Diana Sweeny).*

Using archive film and digital image analysis, we plotted the probable location of the wreck. By July 2002 we were satisfied that we had found the debris field by sonar but had not achieved visual contact. We therefore joined with the American Academy of Applied Science team to bring their Remote Operated Vehicle (ROV) to the wreck's position. On Friday 5th July the remains of Crusader loomed out of the dark lying quietly in 200m of water. *(Crusader wreckage photo courtesy Academy of Applied Science).*

The cause of the accident was the unexpected persistence of boat wakes, including sadly, the wakes of Cobb's own support boats. Speculation about the Loch Ness Monster playing a part was only true insofar as unrecognised boat wakes do cause the majority of humped monster reports, precisely because of their persistence, which means they are not associated with the vessel which causes them.



The Wellington Bomber



The World War II Wellington bomber N2980 had completed fourteen missions when, on New Year's Eve 1940, she ditched in the loch after engine failure. The pilots launched their inflatable dinghy and paddled ashore where a lorry driver gave them a lift into Inverness and the New Year celebrations.

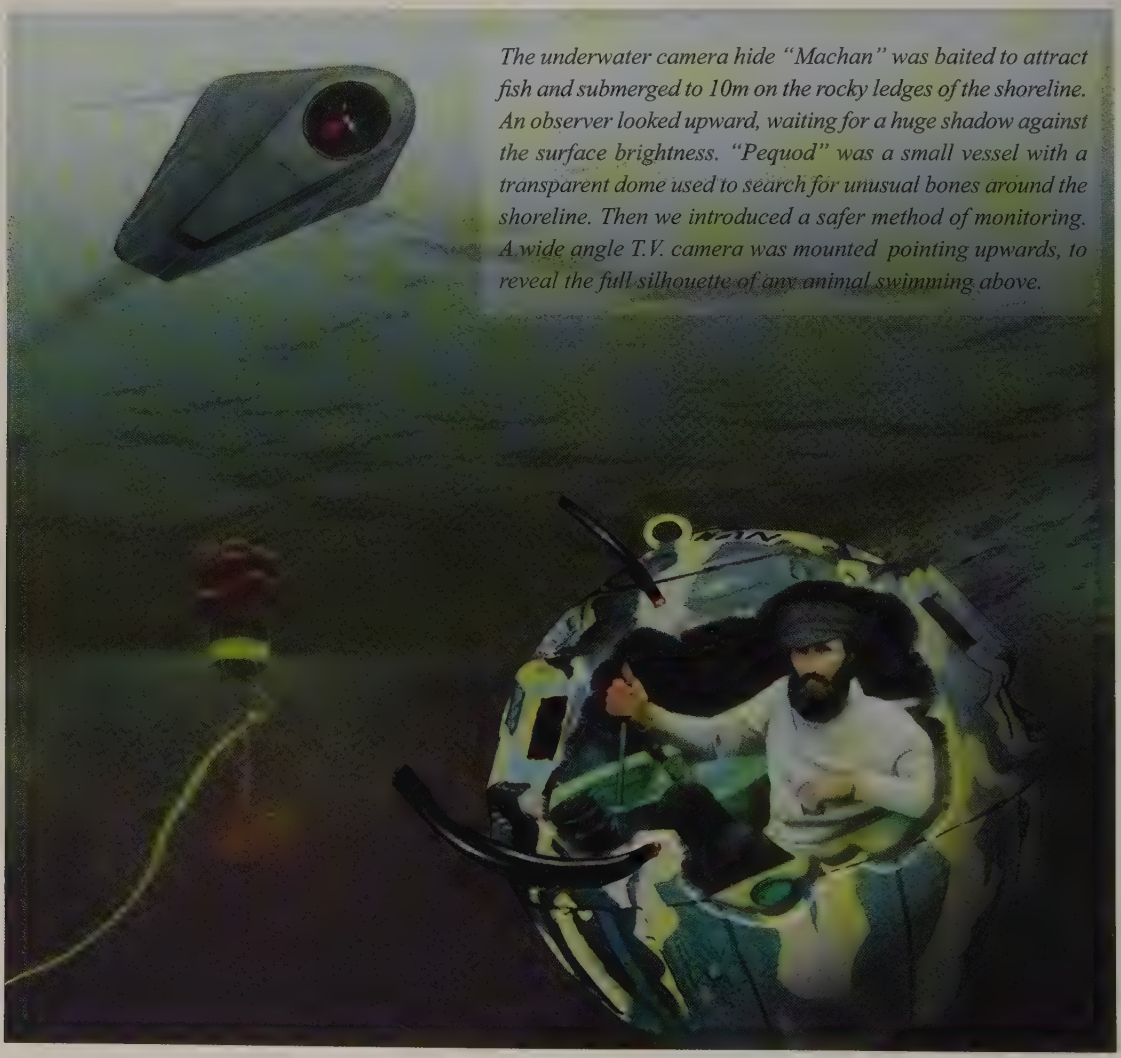
Marty Klein, working with the Academy of Applied Science in 1976, discovered the lost aircraft on side-scan sonar. It was lying in 70m of water, which was too deep for a scuba diving survey. Therefore, in 1981 the Project's research vessel "John Murray" assisted Robin Holmes of Heriot Watt University by providing a platform for a survey by the Remote Operated Vehicle (ROV) "Sea Pup". The Wellington was recovered in 1985 and restored for exhibition at "Brooklands" in Weybridge where she had been built. There is a commemorative plaque beside the A82 road at the northern end of the loch.

Underwater

By 1972, the "Loch Morar Survey", had established that this, the deepest Scottish loch, also had quite a credible monster sightings record.

This is where the story takes a more personal turn since I was then an amateur naturalist, who as a schoolboy had been fascinated by the news of investigations at Loch Ness. I had also read of the encounter on Loch Morar in 1969 when a boat was reportedly rammed by a large creature. This account led to the formation of the Loch Morar Survey. Their results, published in 1972 persuaded me to visit Loch Morar the following year

It seemed to me that here was an easy prize. If monsters were attracted to small boats then that was the place to be. I already knew that aquatic creatures tended to rise towards the surface at night so that was the time to be there. I hired a boat and over the next week, rowed around the whole of the loch, camping at intervals. At night I drifted using a sea anchor and a spot light attached to a camera with a powerful flash gun. For its part, the beast disdained an encounter and for my own, I grew up a little! For, in the dusk, I had seen a classic hump-backed monster which ... wasn't! Over the past decades, I have never lost my personal interest in the question of lake monsters but if I am known as a sceptical



The underwater camera hide "Machan" was baited to attract fish and submerged to 10m on the rocky ledges of the shoreline. An observer looked upward, waiting for a huge shadow against the surface brightness. "Pequod" was a small vessel with a transparent dome used to search for unusual bones around the shoreline. Then we introduced a safer method of monitoring. A wide angle T.V. camera was mounted pointing upwards, to reveal the full silhouette of any animal swimming above.

investigator then it probably goes back to my resolution that night, that if I couldn't trust my own eyes, I shouldn't trust anybody else's either.

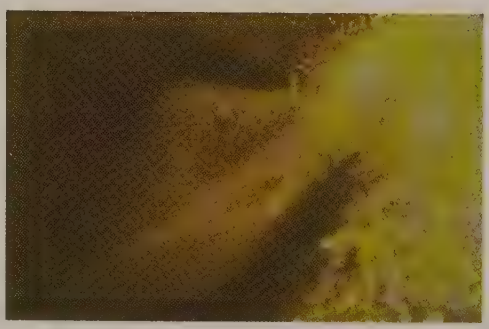
However, during my lone vigil, I had noticed that in contrast to the brown peat stain of Loch Ness, the Morar waters were remarkably clear. Some of the sighting reports suggested large shapes close inshore. Perhaps large creatures were moving in to feed on fish concentrations and perhaps the stalemate reached at Loch Ness could be broken. I was no longer alone and set up a small group called the Loch Morar Expedition. My early expeditions exploited water clarity in a bid to solve the mystery at a stroke.

Meanwhile, back at Loch Ness, Robert Rines of The Academy of Applied Science took on the underwater challenge despite the peaty water, using time-lapse cameras. In 1972 some photos seemed to show shapes within the swirling silt. Published pictures look very much like a flipper but the Academy's photographic expert Charles Wyckoff, cautioned that some had been retouched, probably by magazine editors.

Nevertheless, in 1975 the "flipper picture" became the justification for the naming of the monster, Nessiteras Rhombopteryx; "The Diamond Finned Wonder of Loch Ness". This unusual proposal by Bob Rines and Sir Peter Scott was prompted by concerns for conservation. Further photos now included a nightmare "Gargoyle Head". At first it was believed that the camera was moored too far above the loch bed for any confusion. However, in 1987, a sunken tree stump was recovered nearby, which Wyckoff has found a convincing explanation for the gargoyle photo. In 1976 their cameras were placed beneath a securely anchored raft and no further photographs were taken.

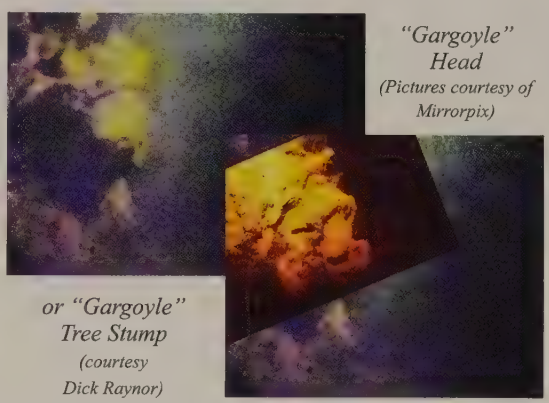
In the same year, we at Loch Morar deployed our "silhouette camera" for over a month. Because the images were moving, we could view them in context, so there are no mistakes.

The philosophy of the enquiry now changed completely. Despite the eyewitness testimony, passive



The "Flipper" Picture
(Pictures courtesy of Mirrorpix)

camera ambush above and below water had failed. The underwater photography era was over. By 1978 my own "Loch Morar Expeditions" had, with



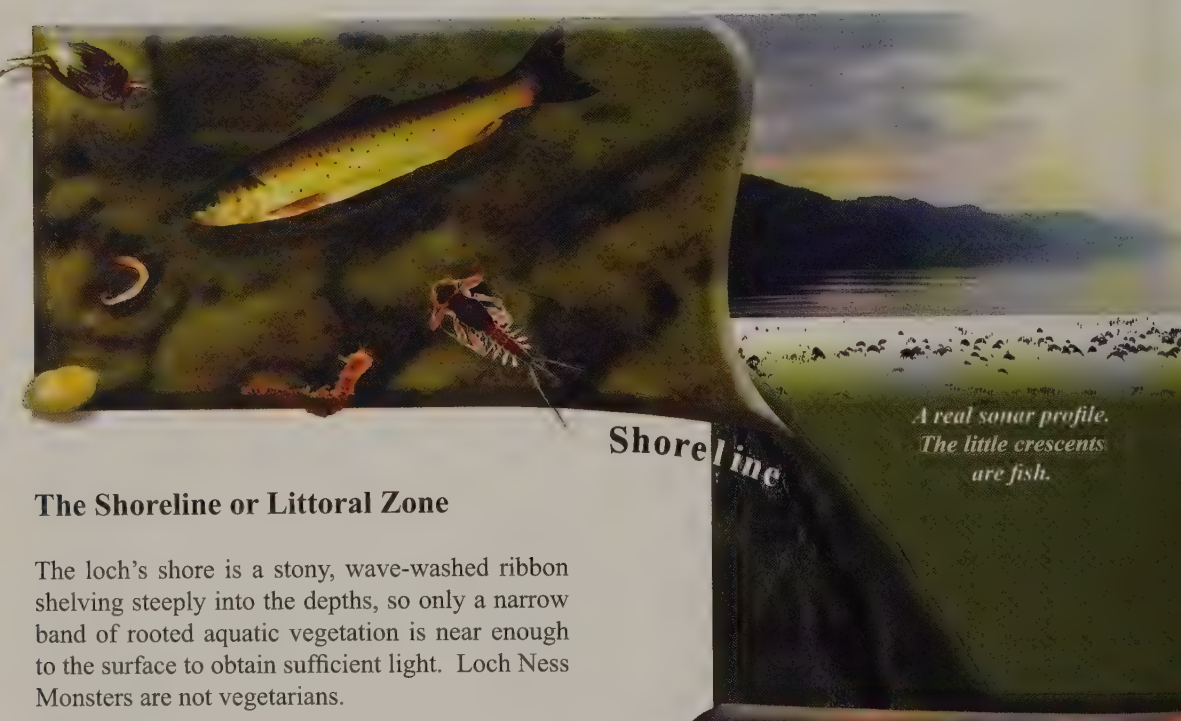
"Gargoyle" Head
(Pictures courtesy of Mirrorpix)

or "Gargoyle" Tree Stump
(courtesy Dick Raynor)

the encouragement of David James and Sir Peter Scott, become "The Loch Ness and Morar Project" to work at both lochs. The Loch Ness Investigation Bureau transferred its material and resources to the new Project. Little did I realise then, that well over a thousand people would become involved in one way or another over the coming years. By the end of the seventies, we focussed on Loch Ness and commenced active examination of the loch's whole environment.

New tools arrived. Sonar sound beams had sometimes made interesting deep water contacts, as in 1968 when Birmingham University recorded huge moving images but sonar definition is poor. So we first examined possible habitats through the lenses of underwater television and the microscope. Beneath the surface, we found a complex and dynamic world.

Habitats Explored



The Shoreline or Littoral Zone

The loch's shore is a stony, wave-washed ribbon shelving steeply into the depths, so only a narrow band of rooted aquatic vegetation is near enough to the surface to obtain sufficient light. Loch Ness Monsters are not vegetarians.

Here the animals are sustained by organic particles washed in. They are mostly insect larvae and are adapted to maintain their position in the turbulence amongst the stones. Some, like the May Fly nymph, have a flattened profile and grasping claws while Caddis larvae find concealment in cases made of coarse sand grains. So, the shoreline animals resemble communities found in fast flowing streams.

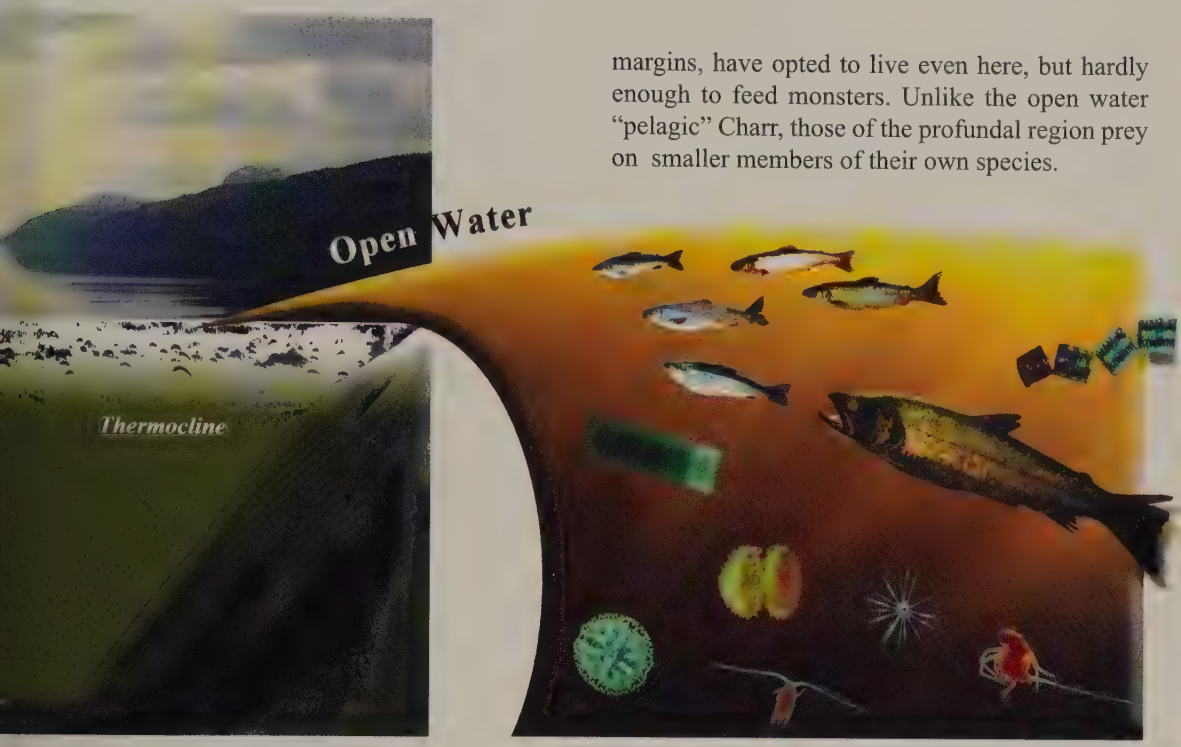
The shallowest water shelters Minnows, Stickleback and Lampreys. Further out are the Brown Trout. Deeper down, especially off river mouths, Eels forage after their 6000 mile journey from the Sargasso Sea and beneath them, are the Arctic Charr. These are the loch's most numerous fish though seldom caught by anglers because they swim so deep. The Atlantic Salmon also pass along the shoreline on the way to their spawning grounds in one of the in-flowing rivers.

Then 200 metres of barren wall plunge downward; clay slopes and precipitous rocky cliffs offer little as a habitat right, down to the flat silts of the abyssal plain.

The Abyssal or Profundal Zone

In contrast to the turbulent shoreline, the flat silts of the 200m deep abyssal plain are a lost world of stability, stillness, constant darkness, refrigerator temperatures and crushing pressure. But a rain of organic particles sustains a surprising variety of life. So far, we have discovered 64 species; mostly filter-feeding in the mud or just above it. The habitat is a

A Menu for a Monster ?



refuge for two interesting groups of invertebrates. The dark stillness harbours large white Copepods such as *Megacyclops*, more usually associated with ponds and quite unsuited to the water movements and predation pressure off the beaches.

The cold water also gives sanctuary to some Ice Age relict species. The tiny pea mussel, *Pisidium conventus*, is more usually found in shallow Arctic streams. Another relict from colder times is a chironomid (midge) larvae *Sergentia coracina*. They live in mud-coated tubes, and to emerge as adults they must swim up through 200m of water, running the gauntlet of Arctic Charr. Some chironomids, such as *Procladius*, are predatory, fastening onto the *Sergentia* and sucking them dry.

The depths have also been colonised by an unwelcome immigrant from North America. The flat worm, *Phagocata woodworthii* could have been introduced on equipment brought here by American monster hunters.

Some of the Charr, themselves exiles from the ice margins, have opted to live even here, but hardly enough to feed monsters. Unlike the open water "pelagic" Charr, those of the profundal region prey on smaller members of their own species.

The Open Water or Pelagic Zone

Most life is concentrated here, in the top 30 metres above the thermocline barrier and closer to the light. Poor nutrients grow few phytoplankton (microscopic plants) such as Diatoms, Desmids, Flagellates and other algae. To make matters worse; the light so vital for photosynthesis, is blocked by the dark water. So there is sparse grazing for the tiny animals of the zooplankton.

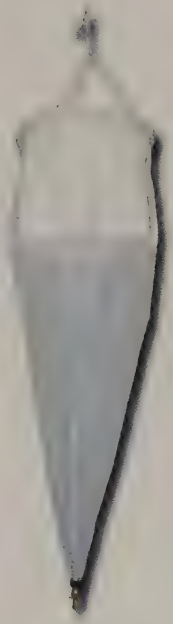
The larger Copepods and Cladocerans, such as *Daphnia* and *Bythotrephes* are the main food for the fish of the open water. At night most of the zooplankton is near the surface but with dawn it sinks into the darkness, presumably seeking concealment from predation. The offshore waters are the domain of the Arctic Charr. These fish extend across the whole surface of the loch at a depth of approx. 24m by day but rise towards the surface at night, probably in response to the zooplankton migration.

There are up to 1000 Charr per hectare but the biomass has been measured by sonar at only about 20 tonnes.

An Indirect Approach

They range in size from 4cms to approximately 30cms and feed on zooplankton.

Trout also compete at shallower depth and up to a length of 30cms may also feed on plankton. Larger Trout however, called "Ferox", hunt among the layers of Arctic Charr, sometimes swallowing prey up to a third of their own length.



Plankton Net

As our biological exploration of the loch progressed, it became increasingly difficult to identify either a habitat or a food source that would be capable of supporting a viable population of resident predators. This was a problem which would come to a head in the mid 1990s. The low productivity of Loch Ness certainly argues against monsters but our years of sampling have also yielded a few surprises to consider.

The lack of chemical nutrients, such as nitrates and phosphates, is just as important in water as on land. These nutrients are the essential fertilisers for plant growth; which in water are mostly microscopic algae. The amount of this "primary productivity" forms the base of the "food chain" and generally dictates the total amount of life a lake can support. In fact lakes are sometimes divided into eutrophic (nutrient rich) and oligotrophic (nutrient poor) lakes. These characterisitcs have further consequences, not only upon how much life can exist, but which regions of the lake it can occupy.

In any lake, the water stratifies in summer. This means that as the upper water (the epilimnion) warms, it becomes less dense and floats on the colder water (the hypolimnion) beneath. The two layers are separated by a zone of rapid temperature change called the thermocline. So the "upper" lake is separated from the "lower" lake until cooled and mixed by winter gales. Photosynthesis is limited to the upper part of the epilimnion where light can penetrate and once the nutrients are used, they cannot be replaced from the hypolimnion beneath until the mixing occurs. The algae therefore die back. However, Loch Ness offers greater usable living space than many shallower and richer eutrophic lakes where the decay of organic matter settling from above, robs the deep water of oxygen, banishing fish to the surface. Deep, unproductive Loch Ness has little organic matter to fall through the thermocline barrier into the vast hypolimnion, so there is plenty of oxygen for life, even in the deepest regions.

Also, the textbook food chain may be oversimplified. The northern basin receives more nutrients, so it is richer in algae, yet paradoxically there are more fish to the south. The larger, southern catchments contribute most of the water and with it, organic plant particles which, though blocking light from the algae, are decomposed by bacteria which can be consumed by protozoans and even filter feeding zooplankton. These in turn support the fish population. Therefore, a substantial amount of the production in the loch does not come from the "primary productivity" of photosynthesising algal plants but from the decomposition of terrestrial plant material. Interesting perhaps but again, the fish stocks are very low.

Water Sampler

Our water samplers and plankton nets were the tools of an indirect, scientific approach. They taught us much more than any amount of standing about with cameras and binoculars. As we shall see, even our study on thermoclines has its relevance to the mystery, especially when we turned to sonar as a research tool in the 1980s.

Sonar Patrol

The habitats and animal communities were now revealed but no lens could show the massive hidden processes within the loch. Ironically the big picture was painted by sound beams. In 1981, we built a special sonar patrol vessel, the "John Murray", a 12m catamaran based on inflatable "sponsons". This vessel ran 24 hours a day in silent patrols along the length of the loch. The beginning of truly systematic assessment of unusual sonar contacts began. The "John Murray" was later to be reassembled at Drumnadrochit, where part of the new exhibition walls had to be built around it!

Day and night, our volunteer crews ranged over the depths. The design allowed us to run silently before the wind with engine stopped, instead of wallowing broadside like conventional boats.

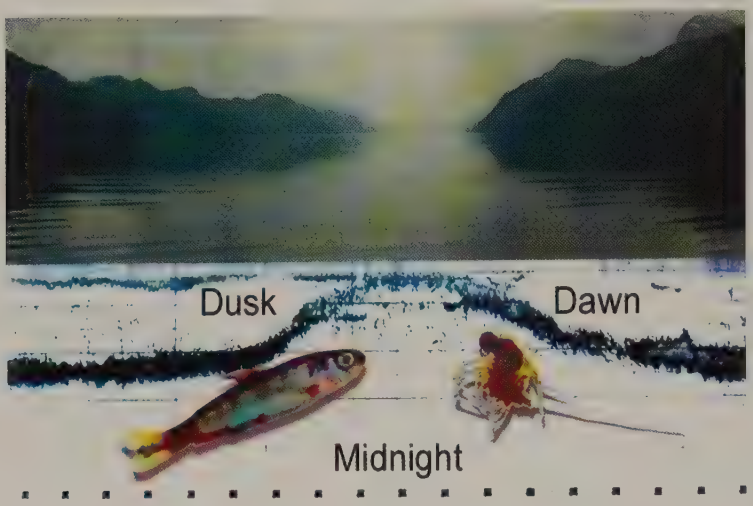
Under subdued lighting, the operators mapped fish distribution by echo sounder. This has a vertical beam and for each fish, successive pulses trace out a crescent shape on the chart paper with the range shortening and lengthening as it passes through the beam.

Sonar only reflects from density changes. Living tissue density is similar to water, so reflects poorly. Therefore, most of the fish reflection (echo) comes from its buoyancy control organ, the gas filled swim bladder. So we used a crude "calibration sphere" to gauge the strength of echoes. It was stronger than the largest Salmon or Ferox Trout about a metre long.

In addition to the echo sounder, the John Murray's scanning sonar swept a beam around the vessel,

1982 Sonar Contacts
This contact shows red against the colour scale and so is stronger than the sphere showing blue
An echo sounder traces fish as crescent shapes.
Our sonar can't show target shape so we talk of echo "strength".
Most of the echo comes from the gas filled swim bladder.
The echo from the sphere is stronger than a 1m. long fish.
Calibration Sphere Echo Trace

The Big Picture



Much of our sonar work has been done from anchored "fixed stations". Here, the chart paper traces the mysterious "Scattering Layer" as it rises to the surface at night.

greatly increasing coverage. In 1982 there were no less than 1500 hours of sonar patrols. The search screen would suddenly flash a contact and while the operator sought to track it, a second screen recorded its strength and depth. Forty contacts of exceptional strength and depth were recorded. Some appeared to move. When compared to the calibration sphere, the red echoes seemed stronger than the largest fish. Obviously, if these were animals then they were probably Loch Ness Monsters and if they were not, then there were no monsters in the deep mid-waters of Loch Ness.

The layer of Arctic Charr extended throughout the loch, with most fish in the southern basin at densities up to 1000 per hectare.Trout concentrated inshore and apparently, off river mouths. But most echoes here were from methane gas bubbles released from decaying vegetation. These give false readings of up to 90 kilos of fish per hectare. It is possible that gas disturbances might cause monster sightings, particularly off Fort Augustus where we recorded one up-welling, 90m down, which remained active for two weeks.

Among the fish we found a mysterious "scattering layer" of very small creatures. They rise at night and sink into the depths again at dawn. Throughout the summer the layer rose and fell in a regular daily rhythm. It is probably the very young Charr coming offshore to follow the evasive zooplankton. These also hide in the depths by day, only venturing up at night to graze the algae.

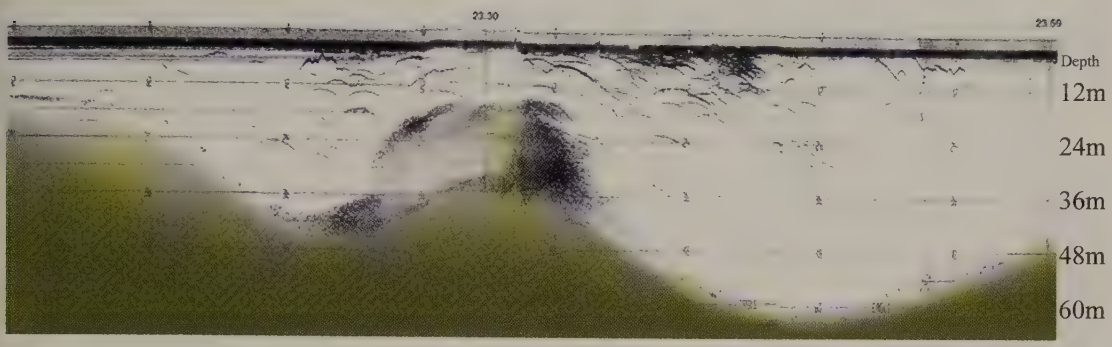
There are other rhythms in the loch. A thinner echo layer is the thermocline, that sharp density change, between the warm and cold water layers.Way back in 1903, Sir John Murray discovered that the thermocline is seldom at rest due to "internal seiches".

The Great Glen is orientated NE-SW; perfectly aligned like a wind tunnel, for the prevailing south westerlies which can drive the warm water north, tilting the thermocline. As the wind drops, the whole thermocline slips back, overshoots and settles into a 54 hour see-saw motion for days, sweeping the plankton and smaller fish back and forth. That is not all. Objects on the surface, such as logs, are then swept along against

"Monster " logs can be moved upwind by "internal seiches".

the wind, looking like swimming animals. It was while recording just such an event in 1985 that I saw leaves and branches sweeping past our moored research vessel, directly into the wind. It occurred to me that this was a prime example of the importance

Underwater Waves



A 40m high underwater wave in the thermocline recorded by sonar. During this "internal seiche", the thermocline dropped from 18m to over 60m in 45mins. We have added the colour to show the warm and cold water layers.

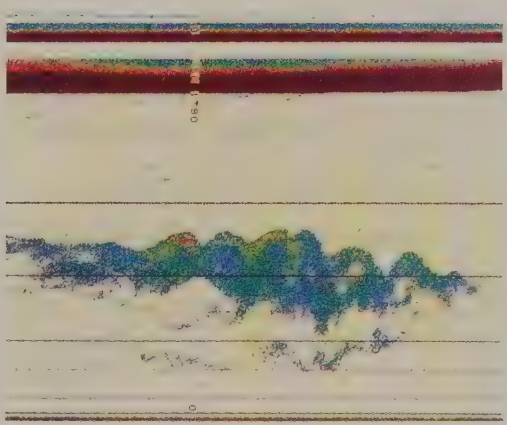
of discovering what is special about the loch. Some of the most reputable sightings refer to an object moving in an unexpected direction in relation to the wind. Thus, a rational deduction can lead to a mistaken conclusion.

A possible example occurred on 17th June 1934 when a sighting was reported by members of the Inverness Field Club including Ex-Provost David Petrie and George MacBean, registrar for the Burgh. The report states that "At first they thought it might be a piece of debris but this theory had to be discarded when they realised that it was travelling against the wind and waves."

On the 8th August there was another sighting by Sir Murdoch MacDonald K.C.M.G. He reported "There was not a ripple on the water"... "At first the creature was almost still but after a moment or two my son pointed out that it had a slow motion towards Fort Augustus. It caused no ripple and moved along about 100 yards in five minutes. Sir Murdoch then pointed the object out to another visitor saying, "Do you see that log in the water?" The visitor exclaimed "By Jove, the Monster!"

In the 1870s there was also a very special sighting far away in Canada. It did much to establish the modern tradition of a lake monster, the "Ogopogo" in Lake Okanagan, British Columbia, long before Loch Ness became celebrated. Mrs. Allison was one of the first European settlers to hear of Indian traditions of a huge creature there. Her daughter recalled "My mother did tell us about seeing Ogopogo in a storm, going up the lake against wind and current. She thought at first it was a log with ducks or other birds on it, until she noticed it was going against the current, not with it".There were other similar stories. Recently, large internal seiches have been recorded in Lake Okanagan! The same is true of Lake Champlain in the USA, another 'monster' lake. Here the oscillation takes no less than four days.

At Loch Ness the illusion is not confined to the surface. During these 'internal seiches', the surge of millions of tons of water creates turbulent waves in the thermocline 40 metres high and travelling majestically at one kilometre per hour. Invisible at the surface, they show clearly on echo charts. They are the largest echoes in the loch. These internal waves reflect and refract sonar beams, especially horizontal ones, in an underwater mirage.



An "Underwater Mirage" Monster

Operation Deepscan

So in 1987, we launched "Operation Deepscan" which drew a "sonar curtain" along the loch using a fleet of vessels provided by the local hire fleet; Caley Cruisers of Inverness.

Twenty vessels were equipped with Lowrance echo sounders and formed a slow moving front line. On making interesting sonar contacts they dropped markers, radioed in, and I sent a follow up flotilla to plot the positions. When the positions were revisited later, most contacts proved to be fixed but three had disappeared. While certainly not 10 metre monsters, they were stronger than fish echoes and lay far deeper. But were they really animals? Perhaps some strong contacts are seals, which are now known to visit the loch almost every year. But the deep water-column could not be their normal habitat, because there is no food. Certainly, no air breather need dive into this barren zone. The contacts remain unexplained.

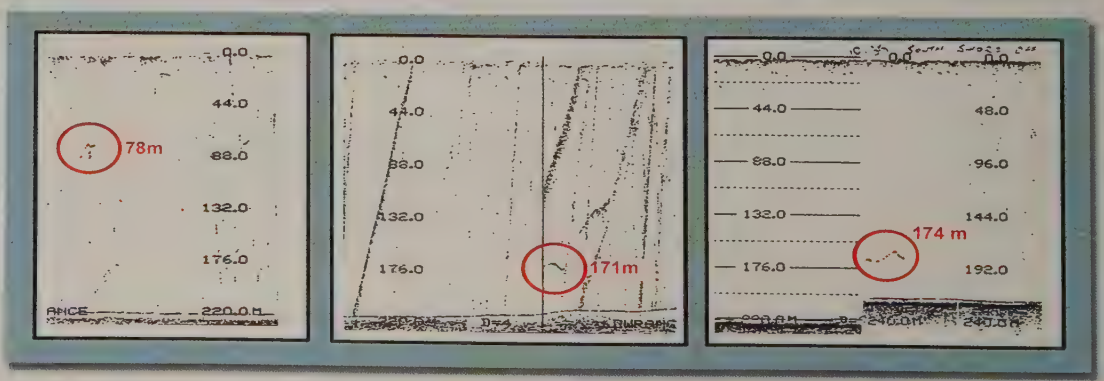
Probably, they caused the gigantic, 30 metre sonar contacts reported by Birmingham University. Boat wakes, the most common Nessies at the surface, also cause echoes on the fringes of horizontal sonar beams, mimicking exciting objects deep down.

Ruthless checking now began. The horizontal beams of scanning sonars could be refracted by thermoclines and then there were always the steep loch walls close by. Rocky facets might cause occasional freak returns as the sonar passed by. Therefore, a similar vessel to the John Murray, called the Monitor, was fixed on a mooring, the sonar scanning around it. Moderate strength contacts were definitely moving but the strongest contacts ceased. Perhaps some were buoyant debris like discarded trawl gear, tethered in some way to the loch bed. Vertical echo beams gave reliable results but lacked the searching power of scanning sonars.

It is still true that most sonar expeditions have reported echoes they do not understand, as we have. Of course, this does not mean that we never will understand them.

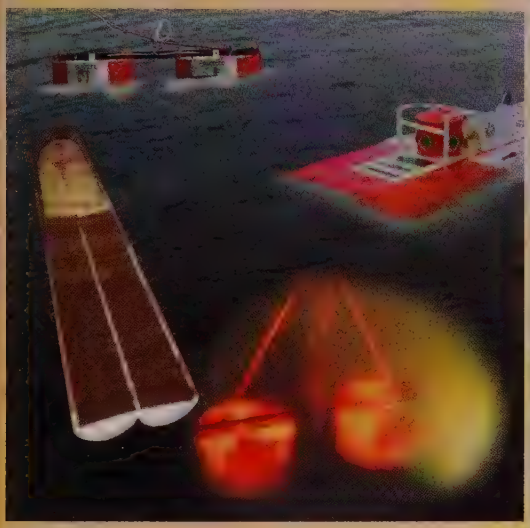
The loch had now been swept for misleading contacts. We had also swept the way clear for science! The 1990s would be devoted to general scientific understanding of the environment. The laboratory in the old Drumnadrochit Hotel would be a busy place. Before the end of the decade, studies from 20 universities were under way.

Operation Deepscan contacts with depths



The ROSETTA "Time Machine"

Deep in the abyss, fine silts build an undisturbed time capsule. In 1994, our ROSETTA PROJECT drove 6m sediment cores through the whole span of human civilisation, into the clays left by the melting ice. The layers, punctuated by winter floods, write the pages of an open book to our history.



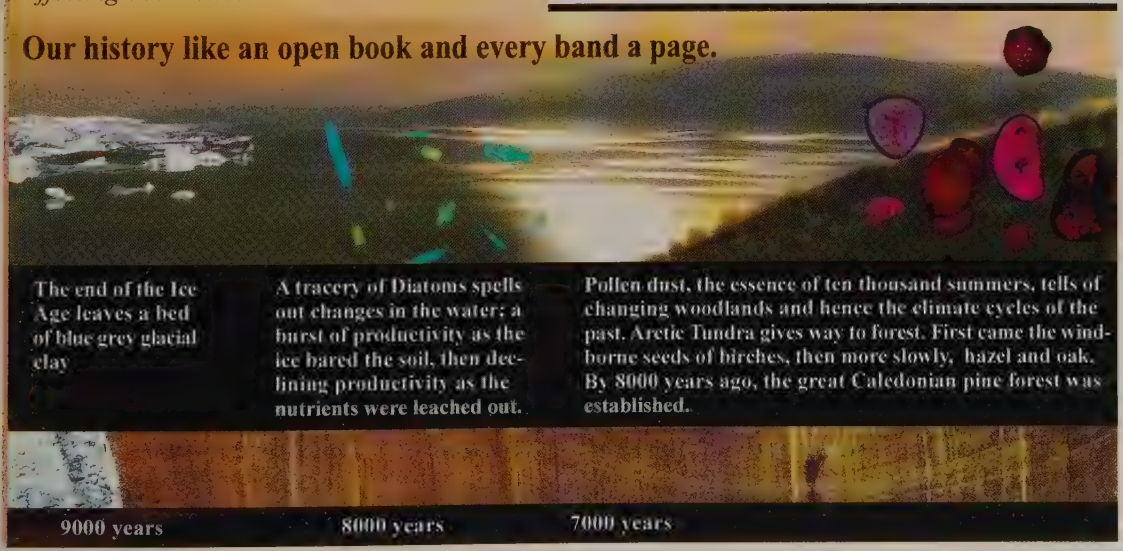
Here are the tiny clues to large events. For example, microscopic plants called Diatoms have silica cases which endure, locked in the sediment. Below is a photograph of one of the 6m sediment cores extended across the following 4 pages with a timeline description of changes affecting Loch Ness.

By the 1990s we were asking how could unusual creatures feed? Where might they come from and of course, what could they be? We joined forces with the Simrad Company whose sonar demonstration vessel "Simson Echo" became the mainstay of "Operation Echo" between 1987 and 1991. We examined the fixed contacts found during Operation Deepscan using an ROV (remote operated vehicle). We began hydrographic mapping using swathe sonar. Most importantly, we completed the first quantitative acoustic estimates of the open water fish population. We found only about 20 tonnes. We were not alone in finding that stocks were low.

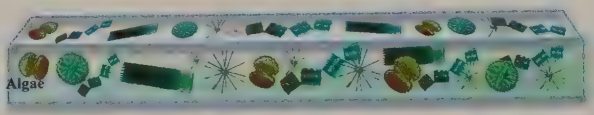
In 1993, Nicholas Witchell's "Project Urquhart", involving the Natural History Museum and the Fresh Water Biological Association, reported that the quantity of open water fish was "incapable of supporting a population of predators". At first they thought that river mouths were more promising with very high numbers of fish echoes. Later these echoes were recognised as methane gas bubbles rising from decaying vegetation.

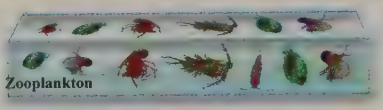
Things had come a long way. A host of illusions above and below the water had now been analysed in detail. It had just been shown that the loch could not support a resident population of very large predators. Yet elements of the sighting record were and still are, very compelling; particularly close encounters before the sensation of 1933.

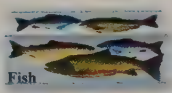
Our history like an open book and every band a page.


The end of the Ice Age leaves a bed of blue grey glacial clay
A tracery of Diatoms spells out changes in the water: a burst of productivity as the ice bared the soil, then declining productivity as the nutrients were leached out.
Pollen dust, the essence of ten thousand summers, tells of changing woodlands and hence the climate cycles of the past. Arctic Tundra gives way to forest. First came the windborne seeds of birches, then more slowly, hazel and oak. By 8000 years ago, the great Caledonian pine forest was established.
9000 years
8000 years
7000 years

Food Pyramids





20 tonnes  **÷ 10**

= 2 tonnes ?

Low productivity does set limits. The low algal biomass is the first step of a food pyramid where each step reduces the possible biomass by about ten.

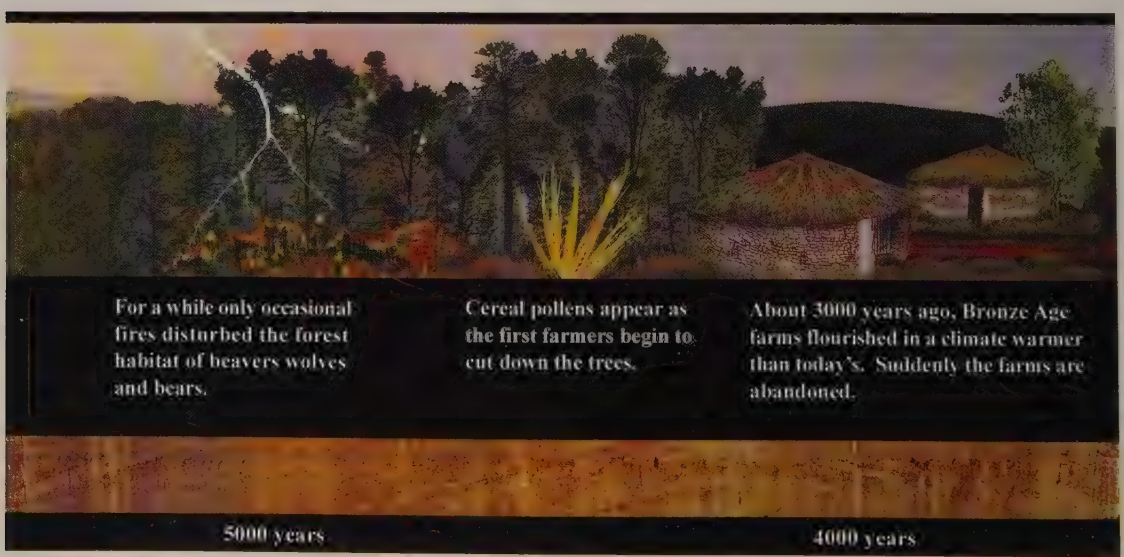
Theoretically, about 2000 tonnes of algae feed 200 tonnes of zooplankton, which only feeds about 20 tonnes of fish. That's the sonar fish stock estimate for Loch Ness. Now, 20 tonnes of fish can only feed about 2 tonnes of monster population, scarcely half a single 10m whale shark, for example. One huge 20m Nessie could weigh up to 50 tonnes, over twice its whole food supply. A viable breeding population of monsters would divide the 2 tonnes of Nessie yet again. This is bad news for a family of large resident predators.

Nevertheless, discussion about what animal could survive undetected in the loch is just as interesting now as it has been over the years. There were clues at the beginning of this little book. It is probably too cold for reptiles to reproduce, so what about other candidates? There have never been any sea-going amphibians like newts or salamanders, so they couldn't colonise the loch in the wake of the ice. Mammals, like seals, may cause some sightings but seldom go unrecognised for long as they need to surface to breathe.

Perhaps the "strange fish" of local tradition should be examined now.

Theoretically, there are even ways in which very large individual fish might arise irrespective of food resources for a breeding population.

This is how we were thinking in the late 1970s. Some suggested that an occasional Eel might fail to mature. It would not return to the Sargasso Sea to spawn. Instead, it would grow to a huge size. Large eels had always been the focus of local ideas. There are some other possibilities too. I had noticed particularly that bottom-dwelling fish tended to surface in calm weather; conditions associated with most monster sightings.


For a while only occasional fires disturbed the forest habitat of beavers wolves and bears.
Cereal pollens appear as the first farmers begin to cut down the trees.
About 3000 years ago, Bronze Age farms flourished in a climate warmer than today's. Suddenly the farms are abandoned.
5000 years
4000 years

Some Candidates

The European Catfish can grow to 3m long

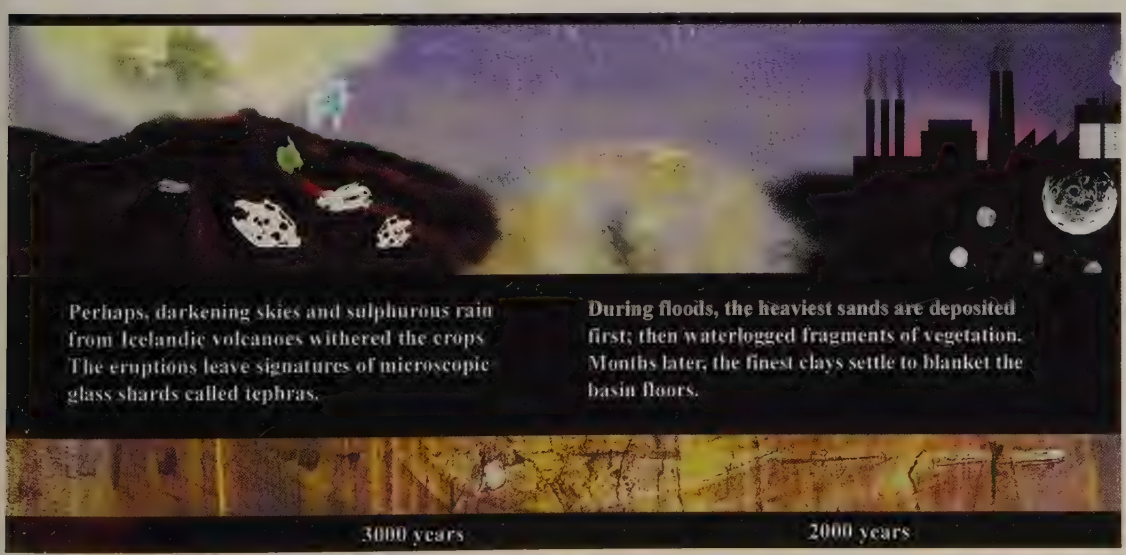
The huge predatory European Catfish, the Wels, is known to surface before bad weather and the Pond Loach was kept as a captive "barometer" for the same reason.

Fish however, spawn numerous small, vulnerable juveniles which develop without parental care. Surely some would have been caught during years of angling, Salmon poaching and scientific netting. However, Dick Raynor, an experienced investigator, points out that a Wels could live for 100 years. A single specimen introduced by man could account for the whole of the modern sightings record, without ever reproducing!

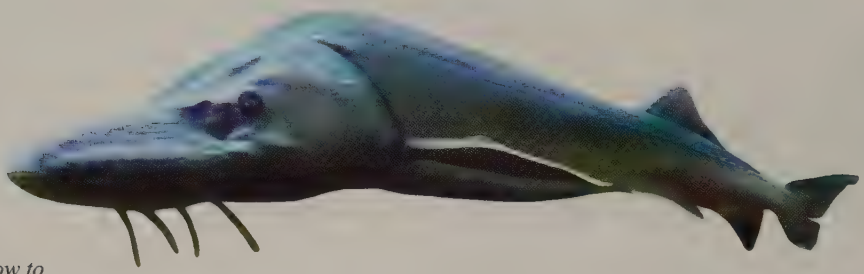
Another "monster" lake that I have worked at is Storsjön in Sweden, where the Wels was one of my prime suspects and recently, cryptozoologist Richard Freeman, found that a Catfish was the culprit "monster" which was attacking swans in a small English lake. If we look to nature for the origin of our monster, perhaps the loch's largest known fish, the Salmon, gives a clue. Their young go to sea weighing only a few grammes. Returning years later, they may weigh many kilos, owing nothing to the loch's meagre food supply. It has been estimated that perhaps 20 tonnes of Salmon a year pass through the loch to their spawning rivers but they do so as quickly as possible, sometimes within two days. Though they are a great bonus to food resources, they are still not considered to be an adequate supply for monsters.

In 1993 I suggested a much larger and rarer visitor to British rivers. Both sides of the argument could be almost right! Early stories of strange fish and perhaps even the Water Horse tradition could conceivably have some foundation in fact, irrespective of the food resources in the loch.

My hypothetical candidate has a primitive reptilian appearance and even evolved in Jurassic times. But it is actually the largest fish ever seen in freshwater where, like the Salmon, it eats nothing. In 1932, the year before the monster sensation, a Miss MacDonald saw a crocodile-like creature swimming up the River Ness. It had a short neck but a long snout and most improbably, two tusks. Was she mistaken?


Perhaps, darkening skies and sulphurous rain from Icelandic volcanoes withered the crops The eruptions leave signatures of microscopic glass shards called tephras.
During floods, the heaviest sands are deposited first; then waterlogged fragments of vegetation. Months later, the finest clays settle to blanket the basin floors.
3000 years
2000 years

A Jurassic Monster After All?



Sturgeon can grow to over 3m long

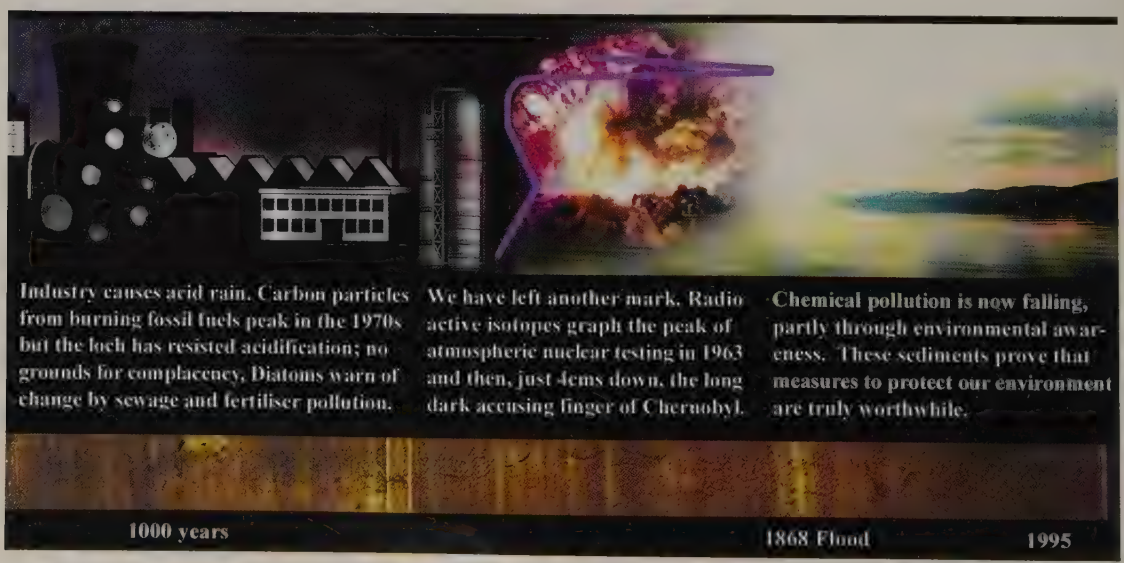
Or had she seen an Atlantic Sturgeon, several metres long, on its way to the loch in a vain attempt to find a mate before returning to the sea, leaving no trace save an enigma? Sturgeon do not spawn in Britain but they have swum far inland, passing weirs and locks. One was caught in 1933 in the River Towey in Wales and another back in 1871, right by the canal entrance at Inverness.

Sturgeon are now almost extinct in our waters and couldn't account for many recent sightings or indeed for the long necked ones! But could the occasional Sturgeon have contributed to the late nineteenth century "strange fish" or even the Water Horses of folklore? If ever a fish had a horse's head it would certainly be the Sturgeon.

A Siberian Sturgeon, a smaller species than the native one, was used in an perception experiment which took place in a pond at the Loch Ness Centre. The first reactions of unsuspecting visitors were observed. Few people recognised it as a sturgeon and some considered it to be most like a shark. Interestingly, others thought it was like a crocodile!

In conclusion it must be said that there is a real mystery at Loch Ness. Whether the answer will teach us more about nature or about ourselves remains to be seen.

Much has now been revealed and we hope that for you, no lake will ever be the same again, but much remains hidden. It is still for you to judge whether the waters are a veil which may one day be lifted or a mirror to our own imagination.


Industry causes acid rain. Carbon particles from burning fossil fuels peak in the 1970s but the loch has resisted acidification; no grounds for complacency. Diatoms warn of change by sewage and fertiliser pollution.
We have left another mark. Radio active isotopes graph the peak of atmospheric nuclear testing in 1963 and then, just 4cms down, the long dark accusing finger of Chernobyl.
Chemical pollution is now falling, partly through environmental awareness. These sediments prove that measures to protect our environment are truly worthwhile.
1000 years
1868 Flood
1995

Faces and Places
1. St Columba
2. Mrs Mackay
3. Bob Rines
4. Alistair Boyd
5. Loch Ness Centre
6. Loch Ness Project
7. Loch Ness Investigation
8. Altsigh Youth Hostel
9. Invermoriston Falls
10. The Great Trap !
Inverness
Dores
Drumnadrochit
Foyers
Invermoriston
Fort Augustus
11. Ian Cameron
12. Biologist David Martin
13. The Spicer's Sighting
14. The "John Murray"
15. Tim Dinsdale
16. Foyers Hydro Plant
17. The Horseshoe Scree
18. Father Gregory
19. Fort Augustus Abbey
20. The Caledonian Canal

A New Perspective !

3D Loch Ness Experience Edinburgh

In recent years, the Loch Ness Project has used stereo-video techniques for underwater and other filming. This innovative technology has made it possible to share the story with even greater realism.

Presented by Adrian Shine, the "3D Loch Ness Experience" is a stereo-video production, in the heart of Edinburgh at Old Parliament Square on the 'Royal Mile'.

The Loch Ness journey begins when you put on the stereo headset. Starting in Edinburgh, you are soon over the hills, and diving deep beneath the dark waters of Loch Ness. Personalised narration is available in English, French, German, Italian and Spanish.

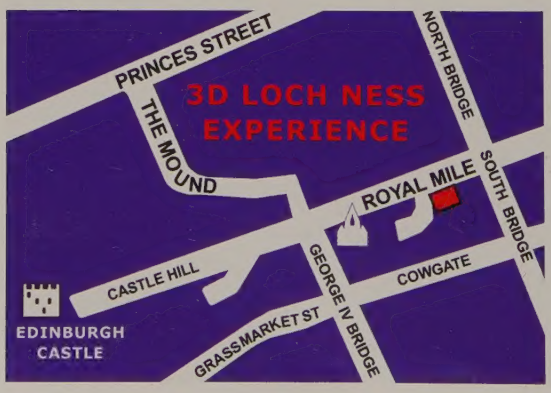
School groups can download a curriculum linked workpack online from the website at:

www.3dlochness.com

The Stereo Crew
John Minshull Skipper & Engineer.
Gary Richardson Exhibition Manager.
Maralyn Shine Video & Graphics.

"The Ultimate Loch Ness Experience".

David Bremner
The 3D Loch Ness Experience
Parliament Square, Royal Mile
Edinburgh.
Tel: 0131 225 2290
info@3dlochness.com



The 3D Loch Ness Experience also houses

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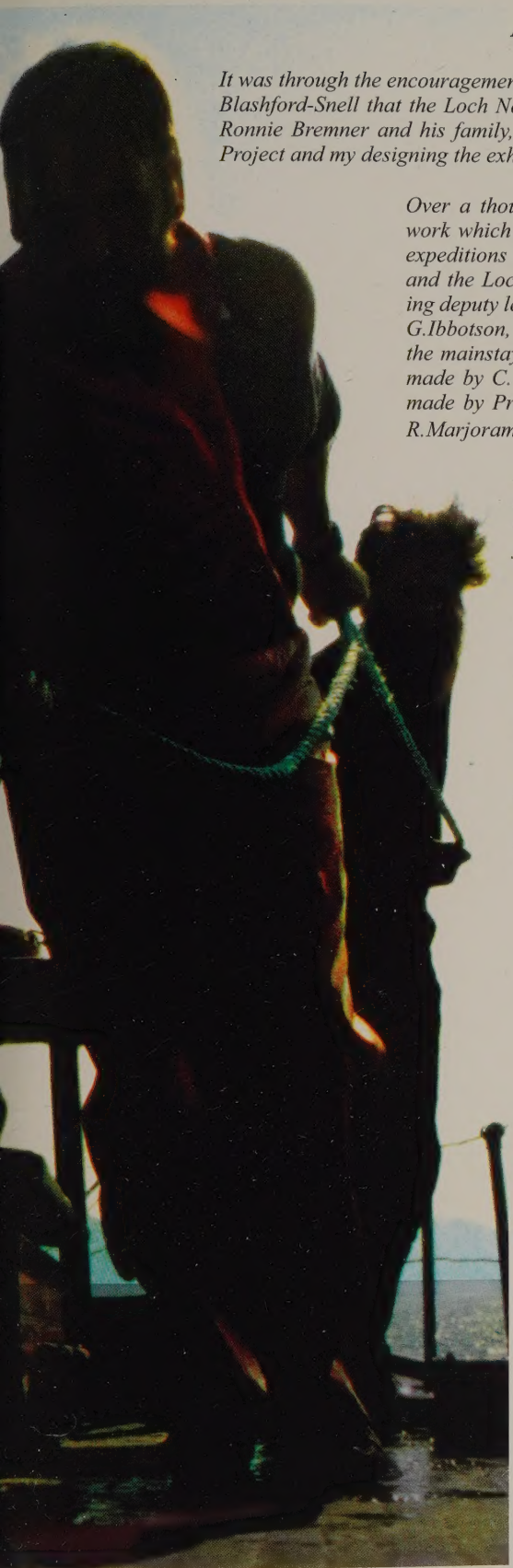

Acknowledgements

It was through the encouragement and support of David G. James, Sir Peter Scott and Col. John Blashford-Snell that the Loch Ness Project took the field in the 1970s. Later, my meeting with Ronnie Bremner and his family, led to enduring friendships, their support for the Loch Ness Project and my designing the exhibitions.

Over a thousand people have contributed in one way or another to the work which is described here. Tribute should be paid to all the volunteer expeditions members, such as the Loch Ness Investigation of the 1960s and the Loch Ness Project. Special thanks to the early volunteers including deputy leader R.Shepherd: B.Bell, M.Beauchamp, R.Gardiner, J.Harper, G.Ibbotson, J.Say, S.Volk, G.Williams & T. Wicks. David Martin has been the mainstay of the biological work since 1981. Project micrographs were made by C. Chesney. More recently, outstanding contributions have been made by Project skipper and engineer J. Minshull, S.Bennett, B.Herring, R.Marjoram, P. Rimmer, M.Shine, M.Walton, J.Young and many others.

A full list of those completing dissertations for University BSc., MSc. and PhD. degrees may be found on www.lochnessproject.com, together with other published scientific work resulting from Loch Ness Project collaborations. Special mention must be made of Drs. Nan Duncan & Jan Kubecka, Drs. Roger Jones, Johanna Laybourn–Parry & Jonathan Grey, Dr. Alan Butterworth, Dr. Bryan Woodward, Dr. Paddy O'Sullivan, Drs. Kate Farr & Anne Wheeler, Dr. Vivienne Jones, Dr. Sylvia Peglar, Prof. Callum Firth, & Dr. Glen George.

Thanks to supporters & contributors:
The Academy of Applied Science, Buccaneer Ltd, Caley Cruisers, George Cocker, Derek Colclough, Tony Harmsworth, Kalagate Imagery Bureau, Marty Klein, Kongsberg-Simrad, Lowrance Inc., Marinspect Ltd., Project Urquhart, Dick Raynor, Bob Rines, The Swatch Submarine, Diana Sweeny, Nicholas Witchell, Alastair Boyd, Gordon Menzies and Charles Wyckoff.

"Loch Ness"

Publishers:

Loch Ness Project

Drumnadrochit

Inverness-shire IV63 6UW.

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ISBN 978-0-9553115-0-5

Available by mail order contact:

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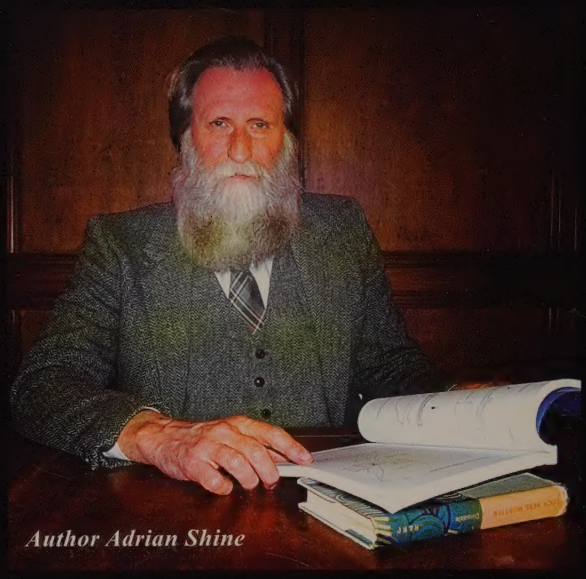

Author Adrian Shine

" A hidden world ... enough water to immerse every man, woman and child on earth more than three times over ... room enough for a few mysteries ... but at last we are beginning to understand it",

says naturalist and Loch Ness researcher, Adrian Shine.

At the Loch Ness Exhibition Centre, he brought together four decades of research into an objective, revolutionary and award-winning exhibition. Now this book follows that very same story and shows how the world famous legend emerged and how the very special environment of Loch Ness contributes some surprising evidence to the debate!

KN-444-937